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ABSTRACT

This report describes a project which assessed the feasibility for the design and implementation of a Center for Scientific and Technical Information (STI) Transfer in the Central New York region, and to lay the groundwork for cooperative projects among Syracuse University (SU), Central New York libraries, regional businesses, and area governments that would strengthen the economic health of existing firms and attract new businesses into the area. Project methodology included a literature review; the gathering of data from members of the Central New York business community and from public, academic, and special library members of the Central New York Library Resources Council (CENTRO) through interviews and questionnaires; and the collection of data on SU via interviews and an inventory of current research activities. It is concluded that regional economic development can be encouraged by better access to and use of business information and STI, and it is recommended that a Center for STI Transfer be established at SU based on a "switching station" model. Appendices include the business questionnaire, the library questionnaire, a listing of selected recent SU funded research projects, and a listing of databases available from DIALOG. A 74-item bibliography is also provided. (KM)

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LINKING CENTRAL NEW YORK BUSINESS, LIBRARIES, AND SYRACUSE UNIVERSITY

FOR ECONOMIC DEVELOPMENT:

FEASIBILITY OF A CENTER FOR STI TRANSFER

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June 26, 1987

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TO THE EDUCATIONAL RESOURCES
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EXECUTIVE SUMMARY

This project assessed the feasibility for the design and implementation of a Center for Scientific and Technological Information (STI) Transfer as a means of encouraging economic development in Central New York. The project was funded by the Central New York Library Resources Council, Gaylord Brothers, Inc., The Greater New York Chamber of Commerce, Niagara Mohawk Power Corporation, and Syracuse University. The study concludes that a coordinated effort among the business community, the library community, and Syracuse University to establish a Center for STI/technology Transfer is not only feasible, it is essential for the economic growth and vitality of the region.

Chapter 1 of the report summarizes the importance of STI and concludes that a coordinated information infrastructure is an essential ingredient for facilitating regional economic development. The second chapter briefly identifies key points related to STI in the innovation process, university-industry cooperation, and models for STI transfer. Chapter 3 describes the project methodology and the data collection techniques used for each of the three main constituencies of the study: the Central New York business community, Central New York libraries, and Syracuse University (SU). The findings from the data collection are presented in Chapter 4. The last chapter offers conclusions, an approach for the design of a Center for STI Transfer, and recommendations for developing such a Center.

The study found that regional economic development can be encouraged by better access to and use of "business information" as well as "STI." Further, many firms in the region are not knowledgeable about techniques for information resources management (IRM) and may not appreciate the value of information as a tool for economic development. The regional library community is well-organized for resource sharing and, given appropriate incentives, would be able to assist in the provision of business and STI.

The research and development (R&D) environment in Central New York has great potential for expanding existing businesses and attracting new ones to the area. In 1986, SU received \$33 million for funded research and a number of major research initiatives are underway--including the building of a \$50 million Science and Technology Center. However, there is little interaction between SU and the local business community for coordinating R&D activities or STI/technology transfer for regional economic development.

The study recommends that a Center for STI Transfer be established based on a "switching station" model and a description of the services and activities for the Center are given in Chapter 5. In addition, the study recommends that strategic planning will be necessary at three different levels if such a Center is to be realized:

- o among regional government/private sector agencies
- o within Syracuse University
- o between Syracuse University and regional government/private sector agencies.

To maximize the benefits from this expanding R&D environment, an effective STI/technology transfer system is essential. The region has the resources and skills to establish such a Center and should move forward to do so.

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CHAPTER 1

INTRODUCTION

The United States is a world leader in research and development (R&D) in a vast swath of subject areas, and yet we seem to be falling behind other countries in our ability to convert this knowledge into commercial success. Foreign nations have been able to develop their economic systems by two key strategies: forging cooperative links among educational institutions, industry, and government; and better management and application of scientific and technological information (STI) (Ballard, McClure, et. al., 1986). These two strategies can be used in local areas as a basis for improving regional economic development.

IMPORTANCE OF STI

In a recent proposal to establish a U.S. National Technology Center to aid in the collection and dissemination of technological information, the authors stated (Vlannes, et. al., 1985, p. iii).

the optimum processing and flow of scientific and technical information, data, and technology...[is]...important not only for competitiveness via technology transfer and application but also as a means of increasing productivity and improving the quality of products and services.

This concern for better utilization and transfer of STI into commercial arenas is being addressed across the U.S. in federal, state and local initiatives to improve conditions for technological innovation.

For example, The April 10, 1987 Executive Order, Facilitating Access to Science and Technology, explicitly outlines strategies and regulations to

increase the effectiveness by which federal STI is transferred into the private sector. The order contains directions to "identify and encourage persons to act as conduits between and among Federal laboratories, Universities, and the private sector for the transfer of technology..." (Executive Order 12581, 1987, Section 1.[2]). The Executive Order continues a policy structure built on the Federal Technology Transfer Act of 1986, Public Law 99-502, the Stevenson-Wydler Technological Innovation Act of 1980, Public Law 96-480, and other policy instruments (Office of Technology Assessment, 1985, pp. 279-303).

In a statement to the House Subcommittee on Government Information, Justice and Agriculture, the Chair of the task group on National Information Systems, Howard Hilton, reported (Hilton, 1985, p. 555):

The principal general observation to be drawn from the work of the Ad Hoc Task Group is that the scientific, technical, and economic progress and international competitive position of the United States depends on the ready access to information as well as its effective use.

This kind of advocacy for STI access and use is not uncommon among those studying the processes involved in developing environments conducive to technological innovation.

IMPORTANCE OF COOPERATIVE ARRANGEMENTS

A major portion of the efforts intended to better utilize available STI include technology transfer between university and industry researchers. In a 1984 report by the U.S. Congress, Office of Technology Assessment, it was noted that local initiatives which aim "to make University resources more widely available, to raise the level of formal and informal communication between academic and industrial researchers, and to increase the speed with

which research results become available to industry..." were contributing to local economic development (Office of Technology Assessment, 1984, p. 59).

The Office of Technology Assessment report (1984) mentioned earlier cited a National Science Foundation study which concluded that "given strong leadership and a stable source of funding, such [cooperative] initiatives can contribute to regional economic development by reorienting university research toward the needs of industry, by attracting outside firms to the region, by improving the productivity of existing firms, or encouraging the creation of new firms" (U.S. National Science Foundation, 1982; cited in Office of Technology Assessment, 1984, p. 59).

Initiatives to enhance local economic development through stronger linkages among universities, industry, and other information providers often fall under the general term "technology transfer." This concept, however, is an umbrella term for a variety of activities, including: retraining efforts for displaced industrial workers, the establishment of research parks, new business incubator facilities, cooperative demonstration projects, industrial extension services, faculty-industry consulting, etc. All of these activities rely on an enhanced information and communication infrastructure, and the motivation of historically separated institutions to cooperate for local development.

IMPORTANCE OF THE INFORMATION INFRASTRUCTURE

Management of a broad range of information resources drives these efforts--and yet it has frequently been treated as a secondary element in technology transfer projects. For technology transfer initiatives to prosper, STI and a broad range of communication and information retrieval/dissemination systems must be managed and coordinated. STI transfer is, therefore, part of

the technology transfer process. It provides a basis, an infrastructure, by which technology transfer can be effective; STI is a necessary, but not sufficient factor for the success of technology transfer initiatives.

Many technology transfer initiatives were born of a need to enhance local economies, in environments often lacking in monetary resources to fund such efforts. One lesson learned from such initiatives is that they must exploit and manage existing information resources and development programs. Unfortunately, many initiatives failed to develop an adequate information and communications infrastructure before implementing the particular technology transfer program.

It is clear that academic institutions and businesses can profit from an environment where the creative interplay of ideas and transfer of STI are encouraged. Businesses may receive product ideas, actual product prototypes, and ideas for improved processes, as well as a tie to a source of potential employees, and a resource for training their current employees.

University researchers, for their part, are assisted in identifying possible funding sources for their research, can increase their consulting opportunities, determine potential sites for student internships and employment, and identify areas requiring additional research. Further, university resources comprise a significant portion of an attractive regional infrastructure for businesses (Bozeman and Bozeman, 1985). Recently, it has also been found that development of university-industry affiliations are a key factor in attracting "high technology" firms to a region (Yin, Sottile and Bernstein, 1985).

There are several essential components involved in the development of effective technology transfer programs--one being a dynamic and active information transfer center. While larger corporations may have sufficient resources to provide information services for both internally produced

materials and externally monitored sources, medium-sized and small businesses often do not (Grashof and Wind, 1981). Consequently, the business sector tends to overlook information resources outside their own environment, such as that available in local research institutions, commercial databases, in libraries, and elsewhere (King Research, 1985).

This condition is explained to some extent by the fact that few scientists, engineers, and businesspeople have been educated in the process of information management or recognize the value of business and STI as a resource from which they can gain competitive advantage (Marchand and Horton, 1986). Such skills, typically, are not taught as part of their professional education. Worse, new information handling technologies appear on a regular basis and have become increasingly complex.

In addition, a number of the database services are not designed with the smaller business in mind (Dore, 1984). Further, business information services can be fragmented and complex to use, and the information needs of the business community are not homogenous (Boumans, 1985). All of these factors point to the need for having trained information professionals actively involved in the management of the regional information infrastructure to encourage successful STI transfer.

Successful efforts to invigorate information-poor businesses with STI have been documented. Two of the most successful Centers have acted as mediators between the commercially available databases containing business, scientific and technical information, and small and medium-sized businesses. These are the Western Research Applications Center (WESRAC) at the University of Southern California, and the New England Research Applications Center (NERAC), located at Mansfield Professional Park in Storrs, Connecticut.

The Centers operate under cooperative agreements with the Federal Small Business Administration as part of the Small Business Innovation Research Technology Assistance Program (King Research, 1985, pp. 14 -15). Significant impact and high levels of user satisfaction have been reported in case studies of these Centers. Other successful STI transfer models are discussed in Chapter Two.

Despite the obstacles inherent in cooperative ventures among universities, libraries, and private sector firms, it is clear that STI resources, researchers, and research products within a given geographic region can be coordinated and managed to enhance the region's information infrastructure. The difficulty, and the challenge, is to mobilize, organize and coordinate a broad range of resources and skilled individuals in the Central New York region, with the specific purpose of improving the transfer of STI for local economic development.

PROJECT BACKGROUND

The lack of a concerted approach to coordinating STI transfer in the Central New York region as a means of facilitating economic development can be cited as the principal impetus for this project. While several individuals and institutions have been aware of the need to investigate this problem, no broad-based effort among the various key stakeholders in the region had been organized.

Overview of Project Objectives

The purpose of this project was to assess the feasibility for the design and implementation of a Center for STI Transfer to encourage economic development in the Central New York region. Such an approach would link

Syracuse University research resources, local libraries, and the business community. STI transfer systems would facilitate communication of and access to business and STI within the region; they would assist local businesses exploit available information resources for improved economic health; and they would strengthen the attractiveness of the region when courting new firms.

More specifically, this phase of the project had the following objectives:

- o identify potential participants for such a Center
- o inventory available STI resources in the region
- o propose possible administrative structures and services for such a Center
- o offer recommendations to resolve key issues related to the establishment of such a Center
- o identify, and if appropriate, seek sources for funding the implementation of such a Center
- o promote local awareness of the importance and value of STI in the process of technology transfer and enhancing the economic health of the region.

Further, the project was intended to lay the groundwork from which cooperative projects among Syracuse University, Central New York libraries, regional businesses, and area governments could be launched as a means of strengthening the economic health of existing firms and attracting new businesses into the area.

Project Assumptions and Limitations

In order to accomplish the project's purpose and objectives, a number of limitations had to be recognized:

- o the project budget was extremely limited
- o the time frame for the project from start-up to completion of the final report was four months
- o data collection techniques were intended to produce a breadth of coverage rather than a depth of detail on any one particular topic

In addition, the study team worked under the following assumptions:

- o business and STI are powerful resources that can be exploited for economic development
- o numerous mutual benefits can be derived by Syracuse University, Central New York libraries, and Central New York businesses through increased access to and use of business and STI.

Perhaps most importantly, the project was funded by the Greater Syracuse Chamber of Commerce, Niagara Mohawk Power Corporation, Gaylord Brothers, Inc., the Central New York Library Resources Council, and Syracuse University. This broad base of support was assumed to be indicative of a cooperative spirit and desire, on the part of all groups, to work together toward promoting the economic development of the Central New York region.

SETTING THE STAGE FOR ACTION

This report finds that establishment of a Center for STI Transfer is not only feasible, but essential if significant economic development in the Central New York region is to occur. Chapter 1 provides an introduction to the importance of STI, cooperative arrangements between universities and

industry, and a well-organized information infrastructure. Chapter 2 offers an overview of selective literature of interest to this project. The process by which the project methodology was developed and implemented is described in Chapter 3. The results of the data collection are reported in Chapter 4 and conclusions and recommendations are detailed in Chapter 5.

It should be stressed that much of the work done in this project is best seen as a "first sweep" at a number of key issues related to the establishment of a Center for STI Transfer. Moreover, it provides a broad perspective identifying issues and concerns from the point-of-view of Syracuse University, local libraries, and local businesses. However, as a starting point, it can provide Central New York decision makers with an outline and recommendations for how best to proceed in the task of managing STI for regional economic development.

CHAPTER 2

KEY POINTS FROM THE LITERATURE

A number of studies have been conducted over the past several years which demonstrate the importance of STI and the positive impact of academic/industrial cooperation on economic development. Some of the work has sought to provide a better description of the innovation process in order to enhance it. Some researchers have specifically sought a better understanding of the role of information and communication in promoting innovation and business success.

The purpose of this chapter is to provide a context for the project. The chapter is not intended to offer a comprehensive literature review and analysis. Selected topics were briefly reviewed and key points have been distilled which might offer a useful perspective for the project. These perspectives provide a background and setting for decisions made in the design of the project methodology (Chapter 3) and the presentation of conclusions and recommendations (Chapter 5).

LINKAGES BETWEEN STI AND INNOVATION/ECONOMIC DEVELOPMENT

It is possible to define the innovation process and processes for encouraging economic development largely in terms of the acquisition, organization, dissemination, and utilization of information--in short, marshaling information resources to accomplish specific tasks. Generally, such an approach is known as information resources management (IRM). While other resources certainly are essential for innovation and economic development to occur, information is the fabric that weaves the various components together into an effective process.

Innovation

An innovation might be a new process or product, an improvement in instruments or methods, or some would suggest, even a "good" idea. Not all innovations necessarily lead to commercialization. However, there is widespread agreement that an environment supportive for the innovation process is a cornerstone for regional economic development. The process is complex and not well understood. One of the best recent overviews of the topic has been written by Kline and Rosenberg who note (1986, p. 275):

Models that depict innovation as a smooth, well-behaved linear process badly misspecify the nature and direction of the causal factors at work. Innovation is complex, uncertain, somewhat disorderly, and subject to changes of many sorts.

Two competing forces drive innovation. The first might be labeled as market forces, and the second might be labeled the forces of progress from scientific and technological research.

Basic research may be stimulated by the idea that a certain technology may have commercial applications. But the various stages, or components in moving from research to innovation to application may vary from setting to setting. Ultimately, however, there may be an attempt to take an innovation and apply it in a particular setting. Such is frequently referred to as "technology transfer." Each of the components in the innovation process as well as in the technology transfer process can be time-consuming, complex, and costly; the success of the entire process depends on close interaction between key players to achieve the desired generation, transmission, and application of knowledge. Each stage, therefore, offers numerous opportunities for "information interventions."

Information Resources and Communication Channels Required

Neway reviews different types of information that may be required to support the various activities in these processes. During the early stage, the scientist needs information to conceptualize the problem and formulate research procedures (e.g., from books, pre-prints, reprints, conference proceedings, journal articles). The next stage calls for specific details on techniques and methods (e.g., from technical reports, local colleagues and students) and data about the availability of materials and equipment and the status of the patent situation.

Later, the need shifts to the general body of scientific knowledge to help interpret data (e.g., from journal literature, non-local colleagues). Finally, the successful application of research results will depend on acquiring knowledge about current economic conditions and trends, the competition's activities, and general business conditions, legislation, government regulations, and markets (Neway, 1985, p. 58-59). But in addition, people conducting research and those involved in the commercialization process must be aware of each others' activities.

Neway also describes the types of information interventions which resolve these needs: the retrieval and extraction of information, the preparation of abstracts and surveys, and the facilitation of communications. She notes that it is imperative that anyone supplying these services be directly and continually in touch with the activities of the R&D work group and company personnel, becoming a part of the informal as well as the formal communications network. Indeed, the most successful R&D projects are those where an information specialist works directly, and regularly, as part of the project team in identifying and resolving team information needs.

Information interventions for R&D success versus those for meeting day-to-day business needs may require different strategies. A report on the Business Partner Program at Auraria Library in Denver, Colorado states that businesses exhibit a broad spectrum of information needs: "companies usually seek information to enhance economic development opportunities; the range of information required to further that development usually falls into three categories: attracting new clients or buyers, working with another company, and developing new products and services" (Fiscella & Ringel, p. 6).

The Pennsylvania Technical Assistance Program (PENNTAP) directs a Library Information System out of the Pennsylvania State University Libraries which is administered by Continuing Education at the University. Both PENNTAP and its Information System highlight the communications facilitator role, having discovered its importance through their own experience. A client contacting a PENNTAP extension agent is referred, if necessary, to a PENNTAP technical expert in one of the University's academic departments. The expert helps the client define the problem and access the needed information; if the client needs help interpreting the information, he or she is referred to a qualified person. The Information System credits its success to "the one-to-one contact between specialists and users, and to the cooperation of university faculty, library staff, and federal and private sources in furnishing appropriate technical information" (Venett, 1981, p. 44).

UNIVERSITY/INDUSTRY COLLABORATIVE MODELS

In recent years, increased awareness of the importance and need for closer links between universities and industries has occurred. Johnson suggests five basic reasons for this increased awareness (1984, p. 1):

- o the urgent sense of global economic competition
- o the need to stimulate technological progress
- o the launching of ambitious technological development strategies by state governments and other agencies
- o increased appreciation for the contributions of academic research, teaching and service to economic development, and
- o a belief in the benefits of close cooperation between academic and industrial organizations.

There are numerous approaches for increasing closer links between universities and industries. The following offers a brief overview.

Classification

There is a diversity and proliferation of academic/industrial cooperative ventures across the United States. Cooperative ventures for R&D include: research centers and institutes (entities which serve as a focal point for special--often interdisciplinary--research interests and activities which frequently receive external funding in a mix of government, foundation, industrial, and institutional support); industry-sponsored contract research; special university/industry research agreements (e.g., Bristol-Myers provided \$3 million to Yale University for the production of anti-cancer drugs); personnel exchange programs; research consortia (involving one or more universities and/or one or more companies); and cooperative research centers (which involve funding from several companies, an advisory structure for industrial input, and an industrial associates program for dissemination) (Johnson, 1984, p. 15-37).

Cooperative mechanisms established for technology transfer are also diverse. They include: university-sponsored seminars, speakers, and

publications; consulting relationships; industrial associates programs (dissemination to, and exchange of general or special purpose information with paying members through visits, symposia, listings and reports of current campus research, etc.); extension services (based on the agricultural model, information and technical or managerial assistance is offered to small businesses to help them solve particular problems); and industrial incubators and parks (Johnson, 1984, p. 39-68).

In addition, fee-based services provided to business and industry by academic libraries also support the technology transfer process. Typical services include: online and manual searching, document delivery, interlibrary loan, SDI, quick reference answers and extended research. Less common are referral to experts in the field, bibliographic control, and end-user or IRM training.

Administration and Structure

Peters and Fusfeld (1983) have characterized the university administration of collaborative efforts with industry, based on visits to 195 campuses. They report that although funds in support of university research are processed in the office of sponsored programs or the development office in practically all cases, it is the faculty scientist who is responsible for the management and administration of the conduct of university/industry programs. They note that advisory boards to discuss policy and programs are often formed to provide company input for industry oriented centers. Some larger programs have two separate boards: a policy board comprised of university and industry officers; and an advisory board comprised of university and industry scientists to map out appropriate projects to pursue (Peters & Fusfeld, p. 41).

The university organizational structure for dealing with industrial research interactions is fairly standardized across institutions. The faculty is responsible for research and education. The central administration (usually encompassing the dean of the graduate school and the office of academic affairs) facilitates research efforts and coordinates administrative procedures.

There is often a functional decentralization of administrative operations in several areas, particularly the processing of funds. The office of sponsored programs, in the research branch of the office of academic affairs, receives funds for externally supported research with a special purpose. Within the office of university relations, the office of corporate and foundation relations is responsible for cultivating sponsors and the development office is responsible for receiving gifts--including those from industry--which usually go toward general university operating expenses. The research is actually carried out within academic departments, at research institutes, or in specialized research laboratories (Peters & Fusfeld, p. 27).

In 1983, the National Science Foundation (NSF) published a review of the literature concerned with technological innovation and innovation process research. The study describes the nature of the boundary-spanning structures which are usually set up to accommodate any academic/industrial venture (National Science Foundation, 1983, p. 173):

Interactions between university and industry involve real people, things, and ideas. As such they must occur in a defined space, time, and setting. The units involved in such transactions are "boundary-spanning" units. Depending upon what is being exchanged, these structures could be part of the university, part of the industry space, or could occupy some original space between them.

The study goes on to offer an important insight into the relationship between communication channels and organizational structure (ibid.):

One often neglected organizational design issue is the necessity to legitimate and structure the informal university/industry interactions that already exist and to define the implicit boundary-spanning structure involved.

Boundary spanning is essentially an information management activity. Overall, encouragement of boundary spanning activities are essential and usually comprise the following activities (Harman and McClure, 1985, pp. 208-219):

- o representing
- o scanning
- o transacting
- o linking/coordinating
- o gatekeeping
- o monitoring
- o protecting.

Effective boundary spanning by both the university and the industrial participants can eliminate some of the barriers and problems (discussed later in this section)--especially if conducted in the context of an open and effective information transfer system.

A report on the federal role in fostering university-industry cooperation includes a survey of industrial extension services, offers some findings which may be useful in designing such activities between Syracuse University and regional industries. The industrial extension model, an "integrated system of education, research, and dissemination" (General Accounting Office [GAO], 1983, p. 36), seems appropriate to the goals for such a Center at SU. The report notes that (p. 32):

Centers that address less sophisticated firms, or attempt to address more applied and specific sponsor concerns, are more likely to develop organizational structures providing greater levels of industrial input and participation.

The specific programs examined in the report varied considerably in the services they offered, the types of clientele they tended to address, and--perhaps as a result of these two factors--in its administrative relationship with the university (p. 37).

The GAO report describes two separate problem-solving models for industrial extension services. In the clearinghouse approach (PENNTAP is cited as an example here), the center attempts to identify and deliver information and use human resources available in the university relevant to the client's stated need. In the consulting approach, greater emphasis is placed on providing both technical and managerial assistance to improve a client's overall operations. This report goes on to describe how the goals and functions of such programs impact on organizational design (p.45):

Industrial extension programs often work with small, weak firms to enhance their competitive ability. Such efforts require considerable expense. The client firms are generally technologically unsophisticated, cannot define their needs, do not have the resources or abilities to adopt technologies on their own, and are highly resistant to change. In such circumstances the university's traditional academic resources are not useful. Instead, entirely new administrative and delivery structures must be set up to mediate between the university and the client.

In short, the clearinghouse aspects of the model can more easily accommodate traditional university activities whereas the consulting aspects of the extension model may require activities and services with which the university has limited familiarity.

Motivations for Interaction

There is general agreement in the literature about the motivations behind university/industry interactions. Peters and Fusfeld suggest that industry's motivations for interaction with universities are to (1983, p. 34):

- o obtain access to manpower
- o obtain a window on science and technology developments
- o solve problems or get special information unavailable elsewhere
- o obtain prestige or enhance company image
- o make use of an economical resource
- o gain access to university facilities.

The university's motivations include the following (p. 36):

- o new educational opportunities for faculty and students
- o placement opportunities for students
- o new source of money and other resources
- o increase student exposure to real world problems
- o offers challenging work which may help society.

However, for cooperative efforts to be successful, both parties must realize benefits from the arrangements.

The GAO report summarizes the outcomes of successful university/industry collaborations (1983, p. 47-49):

- o early recognition of significant breakthroughs in basic research areas which make new products and processes possible
- o increasing the rate of technology transfer
- o increasing the availability of sophisticated facilities, equipment, and expertise

- o increasing the founding of new businesses that exploit science and technological developments and improving their capacity to survive.

Throughout these outcomes is the recognition that organizational designs should take into account the need for quick access to a variety of material and human resources and facilitate flexible, accurate, and trusted communication channels among various client groups.

Problems and Barriers

Peters and Fusfeld note that gaps in communication prevent many interactions from being successful. Their research suggests the need for some additional mechanism to coordinate and improve communication flows (1983, p. 116). They summarize general barriers as value conflicts, distance, career constraints, information dissemination restrictions, and patent conflicts (ibid., p. 37). Although the organizational and administrative structure of an office which serves to link the university and industrial sectors may not make a significant impact on these barriers per se, it must be visible, flexible, and "powerful" enough to provide direct and trusted communication links among a host of campus and corporate offices.

In a review of the literature on research partnerships between universities and industry, Melchiori (1984) addresses the issue of institutional differences--such as differences in lifestyle, values, levels of quality, tolerance for personal idiosyncrasies, organizational behavior, norms, and processes--as a barrier to successful interactions. She asserts that while some of these exist, "others are carefully cultivated stereotypes and long-held perceptions, myths, and prejudices" (p. 12), and concludes that "Perceptions of the hard-driving, profit-oriented corporate manager and the theory-minded professor need to be overcome..." (ibid., p. 12).

One problem afflicting any boundary-spanning unit is the probability that its employees will be caught between the conflicting role demands and reward systems of two separate organizations and two separate subgroups within the parent institution itself (National Science Foundation, 1983, p. 175):

Although personnel involved in boundary-spanning activities in any organization are "different" in the sense that the tasks that they perform are at variance with other organization members, they are still part of and drawn from the larger organization. They are thus subject to the norms and reward systems of two probably incompatible sub-groups of the parent organization.

Citing Selznick, the NSF report mentions that another danger associated with boundary-spanning groups is that they "may become co-opted by those outside or inside the organization with whom they work" (p. 176).

Careful consideration is necessary to determine appropriate communication modes and specific methods by which information is transferred by a center whose goal is to aid local economic development through technology transfer (ibid., p. 220):

Systems of technology transfer which place the major responsibility on the user to identify needs and possible technical solutions do not transfer much technology; however, strong "technology push" systems run the risk of transferring inappropriate or unusable solutions which have a low rate of effective implementation.

Success Factors

The one success factor which appears most consistently in the literature relates to the personal qualities of a center's director. In Melchiori's words: "There is agreement at this time that the best success predictor is

the availability of an individual who assumes leadership and initiative in the pursuit of linkages and who in turn draws others into the partnership" (1984, p. 18). According to Peters and Fusfeld (1983, p. 41):

The most successful interactions are almost always initiated and nurtured by a key individual who is energetic and has a belief that the success of the program is essential to his professional development. This person must demonstrate management capabilities as well as excellence in science. Very rarely do programs succeed which are developed conceptually at the top levels of university administration.

While administrative "agreements" need to be consummated at upper levels of administration, day-to-day operations must be flexible and directed by someone who can "speak the language" of both the academics and the industrialists.

Other success factors for university/industry ventures which appear in the literature include: the existence of a "program, lab, or center through which a specific project can be sponsored and supervised" (Melchiori, 1984, p. 18); commitment by faculty and administrators to the concept of devoting a portion of university resources and expertise toward the needs and opportunities presented by industry; flexibility in allowing policies and organizational developments for interaction which can be responsive to industry without compromising the academic mission; sustained sources of funding; and a strong commitment to community service (GAO, 1983, p. 50).

STI TRANSFER MODELS

The NSF study allows that the literature generally "fails to provide data about which mechanisms transfer what kinds of information best" (1983, p. 171). It stresses that developing and maintaining appropriate communication mechanisms is an important aspect in the organizational design process: the

modes and style of communication among participants is probably at least as important as the structural setting.

For example, empirical data (Tornatzky et al., 1980) and practical experience suggest that information exchanged via person-to-person interaction is more readily assimilated. Numerous other studies confirm that the single most effective STI transfer mechanism among scientists and engineers is interpersonal communication--usually one-on-one (Garvey, 1979). Indeed, use of "knowledge vendors" who link public agencies and private technology suppliers can serve as effective boundary spanners.

Eight examples of STI transfer operations are presented on the following pages. These centers fall into three basic categories:

- o academic library models
- o university-wide technology transfer models
- o statewide, government-supported models.

None of them will (or should) provide a cookbook methodology for designing the organizational and administrative structure for a Central New York Center for STI Transfer, but they are representative of the wide range of existing systems. A few of those described obviously extend far beyond the scope of this project, but they are included here because they present interesting conceptual perspectives.

Academic Library Models

One increasingly common model for an STI transfer system is the fee-based service unit operating out of an academic library. In 1982, the Association of Research Libraries (ARL) published the results of a telephone survey of research libraries concerning their services to the business, industrial, and research communities. Of the 23 libraries responding, 16 had a special fee-

based unit. Although the survey focused on services offered and fees charged, it offered a general description of the types of organizational and administrative structures reported by respondents (Association of Research Libraries, 1982, p. 1):

Some set up corporate service programs as special library units, either independent, or attached to a department. Other programs are advertised services from existing library units, and still others involve contract or membership agreements with schedules of specific services and prices. Some library services are part of an institutional or statewide program. These larger programs normally include access to expert advice, consultant assistance, and sometimes research and development efforts, in addition to library and information services.

The survey indicated that most of these centers focus on transferring information, rather than material. The greatest demand was for obtaining authoritative and accurate data quickly and if necessary, confidentially. Speed was important not only to meet the time constraints of clients, but to save organizational effort.

Another survey of fee-based services in academic libraries was conducted by J. E. Evans (1984). The central purpose of this study was to investigate how such services were organized with the institutional structure. The author notes the striking absence of literature that details the operation of the fee-based service in the organizational environment. The specific systems discussed are: The Michigan Information Transfer Source (MITS), Lehigh University Libraries, The Center for Business Research at the C.W. Post Center of Long Island University, The Regional Information & Referral Exchange (R.I.C.E) at Rice University in Houston, Texas, and ILR: ACCESS at Cornell's School of International and Labor Relations.

Evans remarks that the variety of services is surprisingly diverse and that "the function of these services is largely dependent upon the organizational climate of the participating institute at which these services are offered. There is no consistent plan or model which has been applied in the development of services" (Evans, 1984, p. 19). The impetus to establish the STI transfer systems seemed to come more from the institution's financial problems, user demands, and the availability of new technologies (ibid., p. 19).

Concerning university policy, Evans found that fewer than 40% were required to make formal requests to governing agents to begin operations, and only a few had any kind of formal charter or license. All of the systems reported, however, that they were subordinate to university policy and regulations (p. 26).

Evans summarizes his survey results as follows: "All existing services rely on the following factors: 1) a good library collection, 2) strong support from the host library, 3) strong support from the university administration, and 4) have considerable autonomy of operation whether within the library or university structure" (p. 23).

A manual for a "small business approach" to operating and marketing fee-based services in academic libraries was published in 1983 by the Association of College and Research Libraries as the text for a continuing education course. Some of the ideal conditions it advocates for establishing a fee-based service have applications as well to a similar service that might not necessarily be operated directly out of the university library setting.

These ideal conditions include: nonprofit, tax-exempt status; strong budget with strong university administration support; reciprocal, low-cost loan policies with other local library collections; strong local and national

reputation; status equal to other departments; service priorities; clear reporting lines to decision-makers; no internal conflicts of interest; full operating and planning authority to Director; and a full-time Director with only fee-based service to run (Association of College and Research Libraries [ACRL], p. 14).

The Information Exchange Center, Georgia Institute of Technology

The services offered by the Center are basically the traditional library offerings; it is advertised as a source of "easy access to the varied information resources of the library." Along with manual and online searching, however, it does offer Selective Dissemination of Information (SDI) (1) and document delivery (ARL, 1982, p. 83).

In an article describing the Center, Citron and Dodd report on some interesting planning, policy, and administrative elements. They advise care in setting up a fee-based library system, because "the library does not exist as an isolated unit within the organization.... It interfaces with the rest of the institution in more ways and more frequently than do most other units" (1984, p. 9).

The authors recommend that as a revenue-producing unit, "the library must be considered in relation to the institution's overall fundraising program, sponsored research programs, and the effect that income from private sources might have on state appropriated funds and other agreements the library has" (ibid., p. 9). One serious problem they noted was that strict congruence to the general library policy of assigning priorities to various user groups (with top priority going to students and faculty) had seriously hampered their ability to serve business and industry effectively.

Michigan Information Transfer Source (MITS), University of Michigan

MITS has a separate office in, and is an integral part of, the University of Michigan Libraries. Its head reports to the Associate Director for Public Services. MITS receives no state money. It advertises "a full range of information services" including document delivery, database searching, in-depth reference, and translating. It incorporates some of the services typically associated with the technology transfer function: "referral to experts or data anywhere in the world," "faculty and staff experts in most academic disciplines," and "information specialists who can help your organization analyze research and information problems to determine what sources will best meet your needs" (ARL, 1982, p. 99).

Seeley G. Mudd Library for Science and Engineering,
Northwestern University

This is a new operation which will offer services out of the Library, while retaining administrative autonomy from it. Its clients will include tenants of a major research park. Its services lean more toward the technology transfer function than do those offered in most academic libraries: current awareness, referral between client and university faculty and staff, in-house Information & Referral (I&R) files (2) created for clients, and in-depth reference service to client R&D divisions. This information came from a job posting for an Assistant Director for the center which appeared in the March 1987 issue of College & Research Library News. The technology transfer orientation is obvious also in the educational requirements for candidates: science or engineering degree required; Masters in Library Science (MLS) preferred.

University-wide Technology Transfer Models

Some STI transfer centers are administered not by the library system at a research university, but are viewed instead as one link in the overall campus system for technology transfer. The overall system might include some type of industrial associates program or industrial extension service, and these technology transfer efforts are supported by some appropriate mechanism for the transfer of STI.

Industrial Liaison Program (ILP) at MIT

In Baker's brief description (1984) of MIT's overall technology transfer efforts, it is clear that the fee-based library service functions merely as one portion of a fairly comprehensive technology transfer program. ILP membership includes: "easy access to the expertise of MIT faculty and researchers, both one-on-one and in specially arranged seminars, and access to MIT publications and the resources of the MIT Libraries" (p. 20). The libraries, in other words, play virtually no role in such activities and services as maintaining a directory of current research, visits to and from MIT faculty and staff to discuss research projects, and producing publications or planning seminars and symposia. The libraries merely issue borrowers' cards to ILP members, and provide literature searches and interlibrary loan services. In return for this, however, a portion of ILP revenue is channeled into the Libraries' budget.

Industrial Associates Program at the USC School of Engineering

This program is most closely affiliated with an academic unit rather than with the university's library system or central administration. Industrial Associate members (IA) "allocate" at least \$5,000 annually for the unrestricted support of the Engineering School's teaching, research, and service programs. Participation in the IA Program promises "a formal channel of communication between the company and the University" (Frohberg, 1975, p. 77).

It is the IA Office which serves as the focal point for the exchange of STI and for contact with faculty. Again, the library has little direct involvement. Members are simply allowed full privileges for the use of the libraries, and the library organizational and administrative structure has presumably felt little impact from its association with the program.

Statewide, Government-Sponsored Models

Some state governments have attempted to encourage economic development by supporting efforts to consolidate or coordinate various individual technology and information transfer services and programs. They also tend to rely quite heavily on extension-type services to solve the specific problems of businesses with the help of university knowledge and expertise.

Wisconsin Small Business Development Center (SBDC)

The Wisconsin SBDC is one of forty such State Centers across the United States which is supported by the U.S. Small Business Administration. Its mission is to strengthen the State's economy by assisting new and small businesses. The SBDC program has four main objectives (Awe, 1986, p. 153):

- o to provide one-on-one counseling to owner/managers and prospective entrepreneurs
- o to provide management education
- o to generate basic and applied research
- o to publish and disseminate useful information.

Legislation requires such Centers to maintain a comprehensive and current STI and business collection and provide information searches and referrals. The Wisconsin Center has, however, expanded its services to include a Wisconsin business resources directory, its own business newsletters, reports, etc. Information is disseminated "through the University of Wisconsin campus SBDCs, University of Wisconsin-Extension county agents, and business associations," directly to the business manager (p. 153).

Ohio Resources Network

The Ohio Resources Network is described in a report published by that state's Board of Regents in 1984. It is intended to provide members of Ohio's business and industrial community with access to the resources and expertise of the state's colleges and universities. Through The Ohio Resources Network, clients may also establish contact with other organizations, including small business institutes, a research laboratory association, and the Ohio Technology Transfer Organization (OTTO).

The Network is administered by the Ohio Board of Regents in cooperation with the Ohio Chamber of Commerce, the Ohio Manufacturers' Association, and the Ohio Department of Economic and Community Development. Clients contact a Liaison Officer at each institution. Business faculty do research and referral; business institutes and research laboratories offer procedural assistance, product testing, and basic research. The role of libraries is

not mentioned in the main brochure; emphasis is placed on contacting people to work with the client in resolving unique problems.

The Ohio Technology Transfer Organization is apparently responsible for STI transfer. It "provides coordinated access to technological information, services, and counsel available through Ohio educational institutions, and State and Federal agencies" (Ohio Board of Regents, 1984, p. 14), from central offices at Ohio State University. One full-time OTTO agent is located at each of fifteen technical and community colleges to help small business enterprises "learn and use current technological knowledge" (ibid., p. 14).

Ohio Business, Education, and Government Alliance

The Alliance was proposed in 1982 as a means of achieving economic renewal in Ohio by providing an umbrella governing organization to coordinate and expand existing resources and programs, and to plan new programs. Its goal is to distribute research results, provide a clearinghouse for consultative services, and coordinate training services related to the needs of business and industry.

It would be led by a Coordinating Council, whose function would be to characterize Ohio's economy, identify major themes for economic development, recommend roles for business, government, and universities, and approve membership on--and advise the Ohio Board of Regents on coordinating the work of--three operating councils: 1) and education and training council; 2) a technology and knowledge transfer council that would design and coordinate activities to make current knowledge, research results, and technological advances available in useful form; and 3) a research and development council to oversee programs to stimulate university research efforts geared to promoting business and industry activity.

Of these, the council whose activities seem most relevant to the proposed Central New York Center for STI Transfer is the Council for Technology and Knowledge Transfer. This Council would build on the progress of the Ohio Resources Network and OTTO to (Ohio Board of Regents, 1982, p. 6-8):

- o provide a means of transferring technical and managerial information available with colleges and universities to business and government leaders
- o establish a consultative clearinghouse through which business and government may seek assistance from faculty members possessing unique capabilities
- o increase business and government access to testing facilities, laboratories, technical libraries, and unique equipment available within colleges and universities.

Discussion

The means by which STI has been transferred between Universities, Industry, and Government-sponsored entities presents a wide variety of alternatives for regional planners. However, the history of the success and failure of STI transfer models has consistently hinged on the actual information needs and information utilization patterns of the business communities served. In general, businesses today find information of all types more crucial to their short and long-term planning efforts than ever before. However, before such STI transfer systems can be effective, businesses may need to be educated as to the value and range of applications for such information.

RESEARCH ON BUSINESS INFORMATION NEEDS

A brief review of the literature regarding information needs in small and medium-sized businesses in England and the United States suggests the following (Campbell, 1981; Chen, 1982; Crampon, undated; and King Research, 1985):

- o Directory use and researching a product are areas of greatest interest to businesses.
- o Almost no electronically generated answers to inquiries are requested.
- o Businesses frequently get their information from trade associations. They complain that there is no unified, definite source that can be consulted to determine what is available.
- o Information needs of small businesses include information about related research and development (R&D), patent information and technical data to help refine products or production, and marketing information.
- o Types of information frequently requested include:
 - Accounting/bookkeeping
 - General Business
 - Sales training
 - Merchandising and display
 - Advertising and promotion
 - Inventory and purchasing
 - Government reports and legislation
 - Banking and finance
 - Human relations
 - General management
 - Business law
 - General marketing
 - Layout
 - Office procedures
 - Credit administration
 - Pricing

- o Small businesses in general have the greatest difficulty in accessing marketing information, then related research and development information and the least difficulty in obtaining patent information and technical data.
- o There are substantial problems in getting R&D information, particularly information from private sector projects.
- o Marketing information is in great demand and most difficult to access, this kind of information includes: Current State of and projections of future trends in development of technology, demand or markets; market penetration and domination of competitors; and federal agencies' needs and orientation.
- o -Smaller companies (i.e., with less than 50 employees) have greater difficulty than larger companies (i.e., with 50 or more employees) in getting access to needed information and in having information resources in-house. Cost is a more important factor to small companies.
- o Small businesses use many sources for information including outside libraries and private information services.
- o Many small businesses are confused and do not know where to turn to to get information.

Small-medium sized businesses do not think in terms of technology or STI transfer per se. They lack coordinated approaches for organizational information management, and are unfamiliar with information resources management practices and principles. There is confusion and uncertainty as to organization's specific information needs. Most requested information is related to the companies' day to day "business" activities (marketing, government regulations, advertising, etc.), and not enough emphasis is being placed on STI as a means for companies' economic development.

STI FOR ECONOMIC DEVELOPMENT

This brief review suggests that there are numerous approaches for encouraging university-industrial cooperation. While many such attempts are done in the context of encouraging "innovations," significant benefits from closer cooperation between the two can result from participating together on a wide range of activities. Clearinghouse approaches are most easily implemented in the university setting but may not have as great an impact as the consultive/extension approach--which may be more costly to implement. But regardless of which activities are selected, effective information transfer systems are essential for the success of the endeavor.

Generally, information transfer systems that stress customized services, are designed from a user perspective, and whose information is disseminated in the user's setting by individualized and personalized methods are most successful. Specific information interventions and information brokering strategies need to be flexible, adaptive, and orchestrated by an enthusiastic and effective director. Information interventions in the R&D, innovation, and technology transfer processes are likely to differ sharply from those intended to resolve the day-to-day information needs of individual business firms.

STI transfer systems can be designed using components from each of the three basic models: fee-based library services, university-wide services, and statewide government-sponsored programs. Given the setting at Syracuse University with the CASE Center, the establishment of the Science and Technology Center, and federal support for the Parallel Architecture [Computing] Center, it may be appropriate to consider a Center for STI Transfer that draws upon aspects of each of these models. Regardless of the approach, educational programing demonstrating the value and applications of information resources for regional economic development may be necessary.

NOTES

1. Selective Dissemination of Information (SDI) is an information service where individuals develop a profile of specific topics, subjects, or authors in which they have an interest. The information specialist, then, regularly scans a broad base of information resources (usually through online databases) and provides that person with a list of sources or an analysis of the most recent publications on that topic since the last search. The searches are done on a regular basis--perhaps every week or every two weeks. The service can best be thought of as current awareness.

2. Information and Referral (I&R) files are lists of sources of information (including publications, individuals, agencies, etc.) that provide information about certain specific topics. They are intended to supplement traditional information sources and exploit locally available, unique, information resources that may not appear in traditional reference sources. Typically, they are custom developed for particular topics in specific geographic areas.

CHAPTER 3

PROJECT METHODOLOGY

The methodology used to conduct this study was built on a number of diverse data collection and analysis techniques. Because the purpose of the study was to determine the feasibility of a Center for STI Transfer, the study team believed it best to obtain a breadth of data from key stakeholders rather than a depth of data from specific clientele. In other words, the perceived need for multiple data collection techniques over a spectrum of potentially useful information sources framed the development of the methodology.

In addition, the analysis of the data relied on a combination of quantitative and qualitative techniques. Indeed, recent writers have commented on the need to analyze data in light of perceptions, attitudes, and value stances of those people providing data (Miles and Huberman, 1984). This is especially appropriate when the data are likely to have policy implications--as is the case with this project (Majchrzak, 1984). Further, the use of multiple data sources and reliance on both quantitative and qualitative analysis techniques allowed the study team to compare data from different sources as a means increasing the reliability and validity of the data.

Project methodology was developed in light of a number of constraints. These constraints included a "bare-bones" project budget and limited time to complete the project--only four months. The first month was devoted to literature review and development of the methodology. The second two months concentrated primarily on data collection and analysis. During the last month, the final report was written.

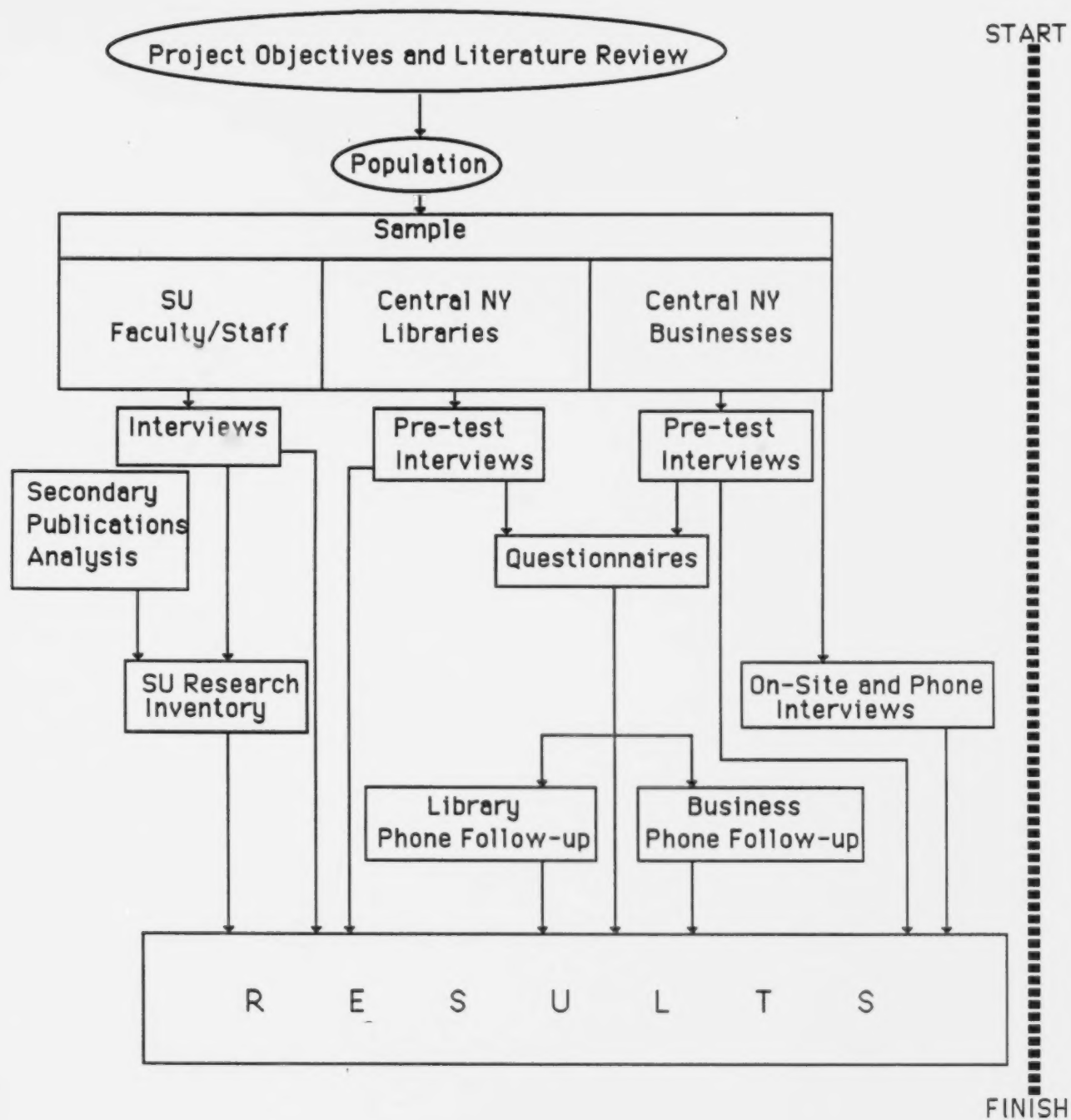
Throughout the design of the methodology and the data collection process, reference to and guidance from appropriate literature reporting on similar STI transfer efforts occurred (see Chapter 2). This review was beneficial because some previous initiatives encountered difficulties due to a failure to exploit the experiences of others. It allowed us to more rapidly identify and explore a broad range of feasible design alternatives.

Project objectives prompted the study team to divide data collection activities according to three major constituencies: Syracuse University, Central New York businesses, and Central New York libraries. The need to gather data covering three large populations, along with time and funding constraints, required that data collection activities be selective rather than comprehensive. Figure 1 provides an overview of the project methodology and suggests the breadth of the data collection activities used for these three constituencies.

Based on the project objectives and the literature review, a sample of data sources for each of the three constituencies was identified. The Central New York region was defined as the four county area of Onondaga, Oneida, Madison, and Herkimer counties. This definition was adopted as it also describes the region serviced by the Central New York Library Resources Council (CENTRO) (1). For each of the three constituencies, a combination of interviews, questionnaires, and review of source documents was used. The results from these activities were analyzed both by quantitative and qualitative techniques. A more detailed description of the method for each component is provided below.

Figure 1

Overview of Project Methodology



CENTRAL NEW YORK BUSINESS COMPONENT

As suggested by Figure 1, the business component comprised the identification of a sample of Central New York businesses, interviews to pretest the questionnaire and obtain other data, administration of the questionnaires, a telephone follow-up interview with a sample of non-respondents, and on-site and telephone interviews with selected larger area businesses.

Rationale

Two recent studies have been conducted of the Central New York business community of interest to this project. The first, Industrial Process Technology Assessment, was conducted by the Syracuse University, Institute for Energy Research for Niagara Mohawk Power Corporation. It provides a wealth of descriptive information about emerging technologies in relation to Niagara Mohawk's, manufacturing customers and offers a profile of Niagara Mohawk's manufacturing firms for targeting technology assessment strategies (Institute for Energy Research, 1986). The second study was undertaken by the Central New York Technology Development Organization (TDO) and focused on technology-based companies in the Central New York region (Doyle, 1986). Its objective was to determine companies' needs for assistance in locating outside technical expertise.

In terms of business information needs and uses, the Institute for Energy Research found that firms look first to commercial vendors to solve equipment and process problems and that exceptional firms look to either in-house R&D or external consultants to improve manufacturing processes. The TDO study found that the primary sources relied upon by companies responding to their survey were individual consultants and educational institutions.

These studies did not have as a specific objective the assessment of Central New York business information needs and uses of STI, nonetheless, they both provide useful data to which readers may wish to refer. The studies provided a background descriptive framework for this project and allowed us to focus sharply on firms' contact with and uses of business and STI. Thus, the business component for this project was designed to not duplicate data available in those reports and stress, rather, a user-oriented STI-based perspective on the general topic of the Central New York information infrastructure and its ability to foster economic development. This focus provides an important perspective that augments the data reported in those two studies.

Research Questions

Based on this rationale, the literature review, and project objectives, the study team developed research questions to guide data collection activities describing the Central New York business community. These research questions included:

- o to which types of information do businesses actually have access?
- o of the information they already have, which is the easiest and which is the most difficult to access?
- o what barriers do businesses encounter in accessing the information they require?
- o what information services would businesses need in order for them to be more productive?
- o to what extent do Central New York businesses use external libraries or library systems in order to satisfy their STI needs? Do they perceive the library or library system as useful or not?

- o to what extent do businesses contact SU faculty/researchers for STI or business related information? If such contact occurs, why? How useful are these contacts?

Questionnaire Development

Previous studies indicate that high response rates from questionnaires administered to the business community on the topic of information needs and uses are not likely. However, useful information can, in fact, be obtained by such an approach. Further, the technique can also be useful if combined with a range of other data collection activities. In addition, the questionnaire approach served another objective of increasing the Central New York business community's awareness of the prospects for establishing a Center for STI Transfer by demonstrating the concern that SU and other funding agencies had for this issue.

Sample

To identify the sample, the study team first analyzed several options. One approach was to include as many companies as possible from the four counties included in the Central New York Library Resources Council (Onondaga, Oneida, Herkimer and Madison). However, due to time and other resource constraints the study team realized that sending questionnaires to a large number of firms in these counties would be impossible. It was therefore decided to concentrate on Onondaga and Oneida counties, where the vast majority of businesses are located.

A review of the sizes of the businesses in these counties showed that the majority employed between 40 and 100 people. Further, other studies have concluded that small companies have greater difficulty than larger ones in

accessing business and STI, and fewer have in-house information resources (King Research, 1985). According to one study, small companies create more new jobs than larger companies, and small firms are often associated with high-technology activities (Johnson, 1984, p. 51). Also, the difference between the number of companies with 20 to 500 employees and companies with more than 500 in both Onondaga and Oneida counties is very small. Based on these factors, we determined that firms with 20-500 employees would be included in the sample.

A member of the study team conducted searches on three online databases to determine the number of companies in the two selected counties with SIC codes in manufacturing, financial services, and professional services, with 20 to 500 employees in Onondaga and Oneida counties (2). The searches in these databases provided us with the number of firms in each county for each of these three groups of SIC codes:

TABLE 1

NUMBER OF MANUFACTURING FIRMS IN ONONDAGA AND ONEIDA COUNTIES

<u>SIC Codes</u>	<u>Onondaga</u>	<u>Oneida</u>
Professionals	300	108
Services	170	47
Manufacturers	173	63

Since it was impossible for the project to support a survey of all these firms, the study team further analyzed this preliminary list.

We concluded that few of the Professional and Service firms were engaged in activities which would allow respondents to provide us with useful data as

to their use of business and STI. Further, we noted that the manufacturing group has been especially hard hit by declining economic growth in New York state. Recent data (U.S. Department of Commerce, 1980) indicate that in 1970 manufacturing accounted for 24% of New York state employment. In 1985 it dropped to 17%, and it is expected to drop to 15% by the end of the decade (Institute for Energy Resource, 1985). Thus, we concluded that a sample comprise of the manufacturing sector might provide us with data better able to address the research questions. In summary, companies selected to receive a questionnaire were identified by the following criteria:

- o located in either Onondaga or Oneida counties
- o having between 20 and 500 employees
- o having manufacturing-based Standard Industry Classification (SIC) Codes (3).

Pretest Interview

With the project objectives, research questions, and sample in mind, the study team developed a draft of the business questionnaire. Some local businesses were contacted, and we discussed this draft with individuals at those firms. Generally, such individuals drew a blank when asked about their strategic use of information, and typically said that they did not use it, or that their secretaries get the information for them.

This response prompted us to redefine the approach used in the questionnaire. Instead of asking them to describe their information needs, we would give them a list of possible information services, and ask them to choose those they would most likely contact. They would also be asked to identify information services not included in the list but which they would like to have.

For the questions requiring a specific response, we were careful to provide a list of options from which the companies could choose, giving them a "not applicable" and "other" option. A section where companies might provide comments regarding their use of information and offer ideas for SU and area libraries to assist them in utilizing STI also was included.

The revised questionnaire was then shown to several people in industry and those on the project's advisory committee for comments. For example, the CEO and research staff of a firm involved in microcomputer-software training reviewed the questionnaire. They pointed out some ambiguous terminology and stressed that the term "business information" should be included as well as the term STI because the former (marketing, local economic information, industry reviews, etc.) are heavily relied upon by management.

An important issue that resulted from the pre-test was confusion by the reviewers as to the term "business information," or just "information," instead of "STI." Sole reliance on the term STI might skew results because respondents did not understand the concept and preferred the term business information. We decided to keep the term STI but provided a definition of it at the beginning of the questionnaire that included business information.

Based on respondents' comments as well as ongoing discussions among study team members, the final version of the questionnaire was produced. Appendix A provides a copy of that questionnaire.

Telephone Follow-up

A telephone follow-up was conducted in order to survey a sample of those businesses which failed to respond to the questionnaire. This data collection technique was especially important for the business component because of the low response rate to the business questionnaire. Determining the reason for

non-response might contribute insights into the attitude of Central New York businesses towards their access to and use of STI, perceptions of SU, and STI transfer in particular.

A random selection of some 20 non-respondent businesses were called during the fourth week after mailing out the original questionnaire. During the conversation, a member of the study team referred to pre-determined questions to guide the conversation. Specific topics discussed were:

- o reasons for not returning the questionnaire
- o relationships with SU
- o appropriateness of a Center for STI Transfer.

Generally, we attempted to obtain as much information as possible, based on questions included in the original questionnaire.

On-Site and Phone Interviews

The questionnaire was targeted at firms with employee size of 20-500 individuals. Another data collection technique was employed to obtain data from companies that had more than 500 employees and were considered as key players in Central New York R&D. We identified a selected list of large companies that were engaged in R&D and also had an information manager or librarian on-site. This list included: General Electric, Agway, Bristol Laboratories, Niagara Mohawk Power Corporation, and Carrier Corporation.

In each instance, either we visited the firm on-site or contacted representatives via the telephone. The person(s) interviewed were administratively linked to the information center, library, or management of company STI in one way or another. The interview was informal and the questions used to start the discussion were those from the questionnaire. In addition we especially probed topics related to the:

- o interaction between the company and SU in the context of accessing STI or conducting R&D
- o appropriateness of establishing a Center for STI transfer and whether the company perceived potential benefits from their participation in it
- o techniques employed and attitudes toward the management of STI.

This activity would complement the questionnaire by focusing on the larger firms and also provide information about library/information services in these R&D facilities.

Data Collection and Analysis

The questionnaire was mailed to manufacturing firms as per the criteria described above. Included in the mail-out was an abstract providing an overview of the project and a self addressed stamped response envelope. The cover letter was addressed to the firm's CEO and indicated that he/she might decide if were more appropriate for another individual in the firm to answer the questionnaire. After a three week period the response rate was 18%. The study team designed a template for an electronic spreadsheet to analyze the responses. However, due to the low response rate, the necessary descriptive statistics were computed manually. Notes were taken during the various interviews, usually by at least two members of the study team. These were then summarized and discussed during later study team meetings.

LIBRARY COMPONENT

When considering the feasibility of establishing a cooperative STI transfer system among libraries, businesses, and Syracuse University to promote area economic development, it was necessary to define a range of possible roles for the participating libraries. Although a Center for STI Transfer and area libraries could serve as a mechanism to link the resources of SU and area businesses, the needs, attitudes, and resources of regional libraries had to be investigated.

Rationale

The information and technology needs of businesses and SU researchers, and the benefits to be derived from such cooperation are more transparent than the attitudes of regional libraries that might wish to participate in such a project. Why would libraries want to participate in this scheme? What do they have to gain? Before these questions could be answered, certain key aspects of such a Center had to be examined and presented to potential library participants for their consideration, e.g., the degree of centralization/decentralization, possible roles/levels of effort open to potential participants, and various costs/fee structures.

It would be important to consider not only the relationship of the libraries to SU researchers and area businesses, but also the relationship of area libraries to the Center and to each other. While the other components are comprised of individuals and firms basically pursuing their own interests and profits, the libraries represent an existing local network whose primary goal is to provide a needed service through cooperative efforts.

Research Questions

Based on the above considerations, the project objectives, and perspectives distilled from the literature, the following research questions were established:

- o what STI resources and/or services are currently available in area libraries, including their physical collection, union catalogs, bibliographic databases, and various kinds of equipment; services such as community referrals, business reference, workshops, use of meeting rooms, etc.; and human expertise such as STI, business information, or computer experts?
- o are any information brokering services currently being used by either the libraries or CENTRO businesses?
- o what library resources are currently being expended on information services to the Central New York business community? What additional resources would libraries need to participate effectively in a Center for STI Transfer? Who would provide them with the additional funding?
- o what is the attitude of area libraries toward cooperative ventures, new technology, non-traditional roles and services, and providing services to the business community?
- o why would libraries want to participate in the proposed STI transfer network? How might they benefit ?
- o which libraries are willing and able to take an active role, for example, as a delivery unit, an intermediary, or as a referral agent?

Questionnaire Development and Pretest Interviews

The library component questionnaire was drafted by one member of the study team and was subsequently discussed at project meetings, undergoing several revisions. The questionnaire was designed to capture respondents' perceptions and feelings on certain relevant issues, as well as to gather factual (i.e., both qualitative and quantitative) data on their current clientele, collections, and services.

The semi-structured pretest interviews were conducted:

- o to test and revise individual questions before mailing out the questionnaires
- o to supplement the questionnaire responses with more comprehensive input from key players in the library community whose opinions of and expectations for the project were viewed as critical elements in its eventual success
- o to "publicize" the project and increase local awareness of the potential economic benefits to be derived from facilitating STI transfer.

The interviews lasted from 30 to 90 minutes. But because of the varied nature of each respondent's relationship with and value to the proposed Center for STI Transfer, the topics discussed with each of them were not identical.

Some interviewees received an abstract describing the project before the scheduled interview; others were given one at the outset of the meeting. The abstract was discussed, and any questions were answered before continuing. In some cases the respondents were given a draft of possible services to be offered by the Center in order to help them understand how it might actually function. Notes from the interviews were recorded manually at the time of the meetings, then typed up later as more formal transcripts.

Each respondent was asked to describe those aspects of the operation of his or her organization which could have a direct impact on the feasibility of a Center for STI Transfer. Such dialogue was generally put in the context of the respondent's contact with the business and research community, possible roles for the respondent's organization in an STI transfer network, and mechanisms for interaction.

The interviewees also were given a copy of the library questionnaire and in some instances a copy of the business questionnaire as well, and asked for comments or suggestions. Their responses were most helpful in refining the questionnaires. Suggestions to improve the format, wording, and organization of material were assessed by the study team and then incorporated in the final version of the questionnaire (see Appendix B).

Sample

The membership list for the Central New York Library Resources Council (CENTRO) served as the chief criterion for identifying the sample to receive the questionnaire. In pragmatic terms, it was also anticipated that the CENTRO network would be a logical starting point on which to build any future network.

Using CENTRO membership as a criterion provided a sample of 113 that included a balanced range of public, academic, and special libraries. A few libraries were excluded from the sample population (e.g., school and medical libraries) because there did not seem to be any immediate congruence between their goals and the goals of the proposed network.

A preliminary list of possible participants for the pretest interviews was developed by the study team. Individuals were included on this list if they represented key libraries in the area, had previous experience in working

with the business community, or were perceived as being able to provide a useful perspective on the research questions previously identified. Ultimately, seven individuals were interviewed, but unfortunately, due to various constraints, not all individuals on this list could be interviewed.

Telephone Follow-up

A telephone follow-up was conducted in order to survey a sample of those libraries which failed to respond to the questionnaire. Although the library component response rate was acceptable, 50%, it was thought that determining the reason for non-response might contribute valuable insights into the attitude of area libraries towards cooperative ventures, in general, and STI transfer in particular.

A random selection of some 15 non-respondent libraries was called during the fourth week after mailing out the original questionnaire. During the conversation, a member of the study team referred to pre-determined questions to guide the conversation. Specific topics discussed were:

- o reasons for not returning the questionnaire
- o perceptions toward local area resource sharing
- o appropriateness of a Center for STI Transfer.

Generally, we attempted to obtain as much information as possible, based on questions included in the original questionnaire.

Data Collection and Analysis

The questionnaires were mailed to the sample of CENTRO members at the same time the business questionnaires were mailed and the same procedures were used (see discussion above). After a three week period, the response rate reached 50%. Necessary descriptive statistics were computed manually.

Transcripts from the pretest interviews and notes from the telephone follow-up were reviewed and analyzed by study team members.

SYRACUSE UNIVERSITY COMPONENT

This component of the study required investigation into a broad range of issues and topics. As suggested earlier in this chapter, our approach stressed data collection techniques that could provide an overview or breadth of information. Thus, this component concentrated on studying STI/technology transfer at SU as a system rather than a collection of separate units and operations.

Research Questions

This component had three rather distinct areas for investigation. The first was to conduct a selected inventory of resources that were indicative of the University's ability to generate STI of use to local area businesses. The basic research question being:

- o what are the current and expected areas of university research and faculty expertise that have potential application to assist in Central New York economic development?

The second area dealt with issues related to the University's involvement in STI/technology transfer. Four main research questions guided this component of the data collection process:

- o what are the areas of research currently being carried out at the University which might have applications of interest to Central New York businesses?

- o to what degree might the new data transfer network, NYSERNET, be useful as a mechanism for regional STI transfer?
- o how might a Center for STI Transfer be administered at SU?
- o what existing University resources, offices and services might play a role in such a Center?

A third area dealt with the degree to which there was bibliographic control and access to SU research resources. The research question being:

- o to what extent is SU research output organized and accessible? If it is organized for access, what form does it take? What media is it in? What information does it contain? How is it accessed, and who can access it?

These research questions guided the two data collection processes for this component of the study. Table 2 summarizes the types of information collected by the interviews and those collected from the secondary publication analysis.

Interview Process

This data collection method relied on the judgments of those people engaged in both research activities and administrative activities in the SU research community. Semi-structured interviews were conducted with some 17 SU faculty members and/or administrators; one administrator at SUNY, College of Environmental Sciences and Forestry; and a representative of Rome Air Development Center. Individuals had to be involved in or knowledgeable about SU research activities, STI/technology transfer, or regional economic development. The interview pool was expanded by initial respondents suggesting additional contact people. A number of individuals were identified who appeared to have useful information related to the study; however, lack of time and resources precluded conducting these interviews.

TABLE 2
RESEARCH TOPICS AND INFORMATION SOURCES

Topics	Information Sources				
	Documentary Sources		Interviews		
	OFFICE CITATION SPONS. INDEXES PROG.	SYR. CATALOGS	ADMIN LTY	FACU	
S.U. Offices involved with economic development.			**		
Structural relations between economic development offices.			**		
Possible participating/ Contributing ORU's.*	**	**	**	**	**
Determination of volume of research and gross categories of research.	**	**	**		
Determination of existing transfer services.			**		
Determination of applicable research.	**		**	**	**
Determination of applicable expertise.			**	**	**
Determination of showcase research examples.	**	**		**	**
Determination of levels of cooperation of economic development offices.			**		
Determination of levels of cooperation of ORU's.*				**	**

*ORU is an Organized Research Unit

Care was taken not to circumscribe the responses of the interviewees. It was considered desirable to have the respondent provide both factual information and creatively consider options and suggestions in response to key issues. The validity of their judgments was appraised in light of data collected from other university officials and information from both the business and library community data collection results.

The interviews lasted from 30 to 90 minutes. The interviews were conducted in an informal fashion and specific questions and topics varied depending on the expertise of the person being interviewed. But generally, the same basic process was followed throughout the interview. First, we discussed appropriate questions and topics to present the interviewee. Next, we scheduled an appointment with him/her. At the meeting, initially, the individual was given a one page project abstract to clarify the nature of the study (if he/she had not already received a copy). The abstract was discussed and clarified for the respondent before commencing the actual interview.

Next, the respondent was asked to describe the tasks of his/her office vis-a-vis University-Industry relations, STI/technology transfer, and/or projects relating to local economic development. Having exchanged this information, a dialogue then began relating the project to the respondent's responsibilities and areas of interest.

Following this portion of the meeting, the respondent was asked to discuss any areas of University research with which he/she was familiar, that might have applications for product development or otherwise be of interest to local businesses. This question was not stressed with those individuals who would have little opportunity to assess University research.

This assessment procedure was formalized by a checklist for those in key positions to evaluate University research activity. The checklist consisted of

those University organized research units (ORU's), current funded projects, and subject areas of special strength identified by preceding interviews, followed by a list of "possible areas" culled from University catalogs, directories, and a review of SU scholarly publications listed in Science Citation Index and Social Science Citation Index. Finally, each respondent was asked to name additional University contact people who might be of interest to the study.

Secondary Publication Analysis

Use of these two indexes was part of the second method of obtaining an overview of SU research activities. During this data collection activity a search of Science Citation Index and Social Science Citation Index by corporate field (e.g., Syracuse University) was performed. This technique would produce a listing of indexed scholarly reports from which we could assess both the quantity of items listed and the topical areas covered. Further, this approach identified specific units of the university with frequent listings and also allowed for a rough comparison to be made between the listings for Syracuse University and other major research universities in the area.

It should be pointed out that there are a number of limitations and weaknesses with such comparisons. For example, there is no assurance that all such research is actually indexed for each institution in these indexes, nor can one assume that the number of items listed is, in fact, an indicator of quality or impact of the research. Nonetheless, with these and other limitations in mind, this analysis was undertaken.

In addition, a number of SU produced documents, reports, directories, computer print-outs, and catalogs were examined. These were identified

through interviews with faculty and administrators as well as, in some cases, by serendipity. The review of these publications provided a perspective on the types of research in place at SU, the likelihood that this research had commercial applications or would otherwise be of interest to the local business community, and the degree to which it was accessible.

Data Collection and Analysis

During the interviews, usually two members of the study team were in attendance and both took notes. Afterwards, these notes were compared and a written summary of the interview was produced. These written summaries were then reviewed and analyzed by study team members during project meetings. A written assessment of these interviews was prepared in the context of the above listed research questions and discussed by the study team.

The analysis of secondary publications resulted in the collection of a broad range of SU publications. These publications were reviewed and analyzed in light of the research questions by study team members during project meetings. A coding form was prepared to report the analysis of citations listed in Science Citation Index and Social Science Citation Index. This summary form was then analyzed to provide data in answering the research questions.

ADVISORY COMMITTEE

An important component of the study methodology was the Advisory Committee. Its role was to review project material, offer suggestions, and provide feedback to study team personnel. During the development of data collection instruments, a number of individuals on the Advisory Committee were consulted and they provided a number of useful ideas and suggestions.

During the fourth month of the project, the Advisory Committee met and reviewed preliminary findings and offered their assessment of those findings. A number of the members also reviewed an early draft of Chapter 5. The involvement of the Advisory Committee greatly assisted the study team in better targeting its data collection instruments and considering the implications of project findings.

SUMMARY

The method utilized for this project had to maximize limited time and resources to collect a broad range of data from a wide spectrum of clientele. Specific research questions guided each component of the study. As shown in Figure 1, multiple data collection techniques were used and both qualitative and quantitative analyses were employed. In addition, the multiple data collection techniques allowed study team members to better assess the validity and reliability of the data.

Overall, the methodology provided a systematic approach to provide a unique perspective from three different constituencies regarding:

- o Central New York STI/technology transfer
- o relationships between SU and the local community
- o issues related to coordinating STI/technology transfer for economic development.

Such a perspective is essential if the feasibility of a cooperative approach to establish a Center for STI Transfer is to be assessed.

Finally, the project methodology was undertaken with a purpose in addition to data collection. Distribution of the questionnaires increased the visibility of the role and importance of STI to a broad range of individuals. A portion of the various interviews was given to publicizing the project,

explaining the importance of STI in the larger context of technology transfer and economic development, and educating participants as to possible goals and benefits of regional cooperation in exploiting business and STI for local economic development. In hindsight, this aspect of the methodology, alone, may produce important benefits when key stakeholders act upon the findings and recommendations offered in the next two chapters.

NOTES

1. CENTRO is one of the "3R's" Councils funded by New York State. It is an umbrella organization whose main purpose is to increase regional access to information; its strongest programs are for improving physical delivery (ILL) and bibliographic control (through the compilation and maintenance of union lists). CENTRO includes among its members all the member and branch libraries of the area's two public library systems, the Onondaga County Public Library (OCPL) system and the Mid-York Library system. It also includes a number of academic, school, and special libraries. The minimum requirements to qualify for CENTRO membership are: 1) the library must employ a professional librarian; 2) the library must have at least 2,000 volumes; and 3) the library must spend a minimum of \$5,000 annually on library materials.

2. The three databases searched were:

ELECTRONIC YELLOW PAGES - MANUFACTURERS DIRECTORY, Dialog's database 510, which provides online directory information for manufacturing firms in the United States. The following are representative of the types of manufacturers covered in the database: Mining, Coal and Oil & Gas Extraction, Chemical and Allied Products, Petroleum Refineries & Related Industries, Primary Metal Industries, Fabricated Metal Products, Electrical and Electronical Machinery, and Measuring, Analyzing & Controlling Instruments.

ELECTRONIC YELLOW PAGES - SERVICES DIRECTORY, Dialog's databases 508 and 509, which provides online directory information for all types of businesses involved in providing a service to the public. The SIC codes cover services included in the following general categories: Personal Services, Business Services, Communication, Transportation, Electric, Gas and Sanitary Services, Miscellaneous Repair Services.

ELECTRONIC YELLOW PAGES - PROFESSIONALS DIRECTORY, Dialog's database 502: provides online directory information for professionals in insurance, real estate, medicine, law, engineering, and accounting. Also included are hospitals and various medical laboratories and clinics.

3. The specific SIC codes for these categories can be found in User Guide to Dialog Information Services (Palo Alto, CA: Dialog Information Services, 1986).

CHAPTER 4

FINDINGS

This chapter describes the findings from the various data collection activities as discussed in the previous chapter. They are organized by the three constituencies, i.e., business, library, and SU component, then by data collection activity, and then by topics. The range of data collected, especially as a result of the various interviews, went well beyond the topics targeted by the research questions. When appropriate, these data are also included.

BUSINESS COMPONENT

The four data collection activities for this component were the pretest interviews, the questionnaire, the telephone follow-up, and the on-site and phone interviews. Summary results from each of these data collection activities suggest that there is limited knowledge about the use of information resources, information handling technologies, and information resources management for day-to-day decision making. While such findings certainly apply to the smaller firms, there are also larger firms in the area that have yet to adopt information management techniques and strategies.

Pretest Interviews

These interviews suggested that firms place heavy reliance on information in trade journals to assist them in accessing "STI." Respondents appeared to be confident that such sources were "up-to-date" and could summarize current developments and activities of interest to them. However, they were dismayed

at the prospects of having to always "flip-through" a stack of such journals when trying to access a particular news item or article.

Interviewees thought that a Center for STI Transfer would be a very good idea--especially if it would assist them in retrieving specific information. Further, they thought that a training and educational component of the Center would also be useful so that businesses might have a better sense of what information resources are available and how they might be used in the corporation.

Generally, as expected, there was little understanding of "library" terms such as bibliographic control, collections, information & referral services, and so forth. There also was confusion as to the difference between conducting market research versus on-site R&D, using business information versus STI, and having a "computer system" and considering that as a corporate information management system. These findings suggest that even if a Center for STI Transfer were established, it is likely that a number of area businesses would not understand the nature of the services it would provide and how they could be applied in their setting without some preliminary educational programs.

Questionnaires

The questionnaires administered to the business community resulted in only an 18% response rate. Thus, detailed statistical analysis of the results is not appropriate. Of the 36 respondents, 13 (or 36%) indicated that they performed R&D. The findings highlighted here contrast those companies that reported that they performed R&D (referred to as R&D companies) with those indicating that they did not perform R&D (non-R&D companies).

Members of an Information-sharing Consortium

Of the R&D companies, 38% belonged to an information-sharing consortium (most likely, CENTRO--see note 1, Chapter 3) and only 13% of the non-R&D ones belonged to such groups. These results were expected and support findings from other studies reported in the literature. Probable reasons for this are financial considerations (small businesses cannot afford to have access to STI) and small businesses consider library and information services as not important or helpful for the company's economic development.

STI Services Currently Available to Small Businesses

The majority of the companies, both R&D and non-R&D, had some kind of STI available to them, mostly in the form of in-house collections of magazines, books and journals, and by retaining outside consultants. Other means of access to STI mentioned were an in-house librarian, and use of online bibliographic databases. Very few used outside vendors or libraries as a means to access business or STI. These results show that small businesses do in fact use business and STI, and yet most of them perceived that they did not engage in any kind of R&D. Apparently, some small businesses do not consider developing more formalized approaches for acquiring business and STI to be necessary.

Barriers Accessing STI

All of the R&D companies realized that they had some kind of barrier accessing STI. Most of these companies mentioned that it was either too expensive, and they did not know how to acquire it, or they could not determine if the needed information was available. Some companies said that

it was too troublesome to identify, and one said that it did not know what is available "out there."

Of the non-R&D firms, the vast majority admitted that they could not determine if needed information was available, and they did not know how to acquire it. Some mentioned that they had no barriers accessing STI, and none of these companies said it was too expensive to obtain or that it was too troublesome to identify.

Usefulness of Library Contacts

Most of the R&D companies had contacted a library or library system (7 out of 13), rating their usefulness as very useful and somewhat useful. Among the libraries contacted were New York Public Library, SU library (they mostly used SULIRS (1)), ERIC (2), SU film rental center, a business library, Onondaga County (used for Interlibrary Loan), Utica College, Cornell University, Utica Public Library, State University of NY (SUNY), and Mohawk Valley Community College. The types of services used were to retrieve articles and books on business and technical information (10K reports (3), reference books, quick reference questions). One company used SU to rent films.

On the other hand, only 17% of the non-R&D companies had contacted a library/library system. Half considered these contacts as very and somewhat useful. Among the libraries and library systems mentioned were Onondaga Public Library, SU School of Management, a database called Battelle CDA, and SU Library (10k reports). The requests centered around obtaining specific information resources and less on information services, i.e., obtaining business information and technical information in the form of articles and research reports.

Usefulness of SU Faculty/staff Contacts

Five out of 13 R&D companies had contacted SU faculty/staff, and rated them as very useful. These companies asked for consulting services on various subjects, and the contacts were made by personal acquaintance with the faculty member or staff. Faculty contacted were in the School of Management, Newhouse School of Communication, other schools (did not specify), and the Kellogg project.

Only four out of 23 non-R&D companies had contacted SU faculty/staff, and rated them as very useful and helpful. Among the schools contacted were the School of Industrial Design and the School of Management. Generally, however, there appears to be minimal contact between those members of the local business community contacted and SU Faculty/staff.

Possible Services to be Provided by a STI Center

The majority of R&D companies wanted a database of key SU research programs and faculty researchers, and customized reports on topics of special interest to their organization. A number of these companies wanted scanning of research activities and identification of those projects with potential for commercialization, as well as an individual profile of their organization's STI needs.

Also mentioned was a database of significant business information services available from selected libraries, an electronic mail system connecting them with the STI Center, and access to government information. Two companies wanted on-site training in IRM, and only one wanted access to commercial on-line databases. For these companies, 31% spent \$500 or less on STI, 54% spent between \$500 and \$10,000, and 15% spent more than \$10,000.

Similar to the R&D companies, most of the non-R&D companies wanted a database of key SU research programs and Faculty researchers, and customized reports on topics of special interest to their organization. Access to government information, a database of significant business information services, and scanning of research activities at SU, were also desired among a large number of these companies. Other services less frequently mentioned were access to online commercial databases and to STI resources available throughout the Central New York region. For these companies, 74% spent \$500 or less on STI, 17% between \$500 and \$10,000, and only 1 (the one that sub-contracted research) spent more than \$10,000. One company did not answer.

Discussion

From these findings one might conclude that the small manufacturing firms do use STI, but may not realize they are using it and tend to regard such use as unimportant for the company's development. It is also interesting to note that the few companies contacting libraries or SU faculty/staff rated them as very useful. The non-R&D companies were more likely to think that they could not determine whether the needed STI was available or not, and did not know how to acquire it.

The main sources used in small manufacturing firms to access STI are collections of magazines, books, and journals. The most wanted services were a database of key SU research and customized reports on topics relevant to their organization. But clearly, the findings suggest that small manufacturing firms in the Central New York region have limited awareness of business and STI and few recognize it as a necessary ingredient for the company's economic growth and development.

Phone Follow-up

The purpose of these interviews was to determine reasons for the low response rate to the questionnaire and obtain information originally asked on that questionnaire. In preparation for the interviews, we prepared a short workform and identified possible responses to the inquiry regarding why the questionnaire had not been returned:

- o the questionnaire did not pertain to your firm or you were not interested in the project
- o too busy to answer it
- o could not meet the return deadline
- o never received the questionnaire.

The study team agreed not to offer these possible responses immediately, but would ask them first the reason for not responding. If necessary, we would then prompt them for an answer.

Generally, we were able to contact the firm's CEO and in some instances spoke with the CEO's secretary. The majority of the answers were that they had never received the questionnaire. Four secretaries answered that their boss had it but that he had not filled it out yet. They said that they would "remind" their bosses to answer the questionnaire and return it as soon as possible. Another said that he did not participate in such questionnaires. Three companies in the sample responded that they would get back to us in case they found the questionnaire, but did not seem to be too interested.

The impression we received from these discussions was that they did not perceive the project as of interest to them, had minimal awareness of the value of business and STI for their firm, but appeared to be "pleased" that Syracuse University was "somehow" interested in the local business community.

On-site and Phone Interviews

For the on-site interviews, we first discussed the nature of the project, provided interviewees with an abstract summarizing the project, and indicated the broad areas that we intended to cover during the interview. These topics were determined prior to interview but were based on topics listed on the questionnaires. The phone interviews tended to be more informal and, in some instances, included discussions over two or more contacts. It should be stressed that these "findings" are based on the views of only one or two people associated with each firm and Bristol Laboratories did not participate. Nonetheless, we believe that their views and perceptions are extremely valuable.

General Electric

After a quick tour of the GE library we began the meeting with the library director and the manager of information resources. They explained that GE's library is now a profit center within the organization. Their clientele includes 300,000 GE employees in Syracuse and 12 other geographic locations. They will work for anybody inside GE that will give them a charge number.

There is apparently quite a bit of information service marketing inside GE. It was stressed that although many engineers are unfamiliar with information access methods, they do not view the job of the GE Information Specialist as bibliographic instructor, but rather as information provider. That is, to put relevant information in their hands as quickly as possible. Some of the interpersonal aspects of information provision to the scientific community were discussed. One of the most important functions of information

providers in this environment is to present information in a non-threatening but yet assertive way. They stressed that engineers and scientists would benefit greatly from information management courses.

They were interested in whether the conceptualization of the project allowed for R&D results to be transferred in one direction only, i.e., to the Central New York businesses from SU, or if it would be an effort from both sides--the latter option being preferable. We explored this notion of a two-way network--how R&D results and expert knowledge could come from businesses into the Center for STI Transfer.

Contacts between SU researchers and GE employees was discussed. Apparently certain laboratories at GE are more closely connected to SU than others. The electronics lab is probably the most closely related to SU because a number of the staff are adjunct faculty at SU. Other links with SU are more informal. It was stressed that their people have come back to GE disconcerted that they cannot obtain from SU and the SU library more useful documents and information than they can obtain from GE's library.

We asked how engineers at the Lab perceived SU's research activities. The response was that some of the engineers were motivated enough and made their own connections with SU, but that having a formal link between both groups would be most beneficial. Apparently, at one point there had been one individual serving as "GE's representative" to the SU engineering community.

GE's information center regularly goes outside the organization to obtain needed information. If it is what they need, the cost is of less importance than obtaining the information in a timely fashion. They regularly use area libraries, but noted a number of problems in accessing STI at the SU library--the least of which was being able to obtain a library card! There was the sense that there probably is excellent information available at SU libraries but that they were not able to physically access it effectively.

We discussed the possibility of disseminating GE's R&D. While such would be possible--and even beneficial for all concerned--they noted that GE had to be conscious of legal requirements for work done with the Department of Defense. Some of this research falls under regulation by International Traffic Arms Regulations (ITAR) and various Export Control laws. These regulations do allow opportunities for joint projects with universities. Apparently it is possible to disseminate some GE R&D, but to do so involves planning ahead for appropriate clearance and completing various GE and federal forms. The team obtained a copy of the regulation and the form necessary for such clearance (4).

Some of the key findings from this interview are:

- o SU library must do a better job of public awareness of resources and interlibrary loan
- o research activities and dissemination of in-house STI must be considered in the context of the Defense-related work being done and fulfilling Defense related security regulations
- o current awareness services of non-classified GE and SU research can be accomplished if desired
- o work with non-U.S.A. citizens (i.e., SU graduate students who are foreign nationals could be a significant problem in joint research activities--mechanisms would have to be developed to accommodate exchange of information in such situations
- o a central office to help local researchers (such as those at GE) identify, contact, and use SU research resources is critically important

- o the research credibility of SU and individual Faculty is not an issue, a bigger issue is the degree to which SU is willing to commit resources in cooperating with the local business community for enhanced R&D productivity.

Exchange of R&D with SU could be better facilitated but arrangements need to be orchestrated by upper SU and GE administrators. Apparently, such conversations have not occurred frequently. Clearly, there is an opportunity here for closer ties between GE R&D activities and those at SU.

Niagara Mohawk Power Corporation

The representative of Niagara Mohawk to whom we spoke reports to the Vice President for Engineering. The office handles the support services (filing, clerical, etc.) for a cadre of engineers. Currently, there appears to be no central approach to management of STI and information resources such as that in place at GE. The interviewee suggested that we might also want to talk to people in Niagara Mohawk's R&D division.

The interviewee reported that a recently formed small task force had met for the past year and had completed a study to document the need for a corporate library. The study demonstrated that company engineers spent considerable time looking for information which could be more effectively handled by an in-house information center staffed by professionals (Niagara Mohawk Power Corporation, 1987). The proposal for establishing an Information Center is currently "on hold".

Presently, Niagara Mohawk has a small, un-staffed room with a few journals, some standards, an index to the materials, and a sign-out procedure. There is also a routing list handled by a secretary. Apparently, there are also departmental collections of information resources, but there is no

control over such materials. The history of information management at Niagara Mohawk is too detailed to relate here. Before the task force study, there had been little serious attention paid to information resources coordination and information management by the company.

The Niagara Mohawk perception of SU as a source of research and STI was that SU does indeed have much to offer, however, it is very difficult to identify and access. Their engineers would greatly appreciate having STI at their fingertips. Our impression of what Niagara Mohawk engineers do now for information is that they talk to each other about access strategies, and are responsible for fulfilling their own information needs. Individuals seek authorization from their managers to spend project money on information resources and services. There appears to be minimal corporate-wide, or department-wide coordination for either traditional library services or management of STI.

Despite present conditions at Niagara Mohawk, much strategic thinking has obviously gone into the possibilities for information utilization in the future. There is an awareness by many that something needs to be done, and a willingness to be open-minded about cooperative linkages. Once again, direct involvement and ability to cooperate in a Center for STI transfer would have to be negotiated by top management with senior SU administrative officials.

Despite Niagara Mohawk's current financial difficulties we believe that significant savings and more efficient use of the engineers' time could be achieved by a central approach to management of STI. Greater direct involvement with other R&D activities in the region, better access to and use of STI in their R&D process, and increased control over the purchase and dissemination of STI could significantly increase overall R&D productivity (Allen, 1985).

Agway Corporation

The individual we spoke to at Agway Corporation was associated with the library and felt that the utility for a closer connection with SU R&D activities was limited because SU was not agriculturally oriented. But it was also mentioned that Agway had diversified lately, and now owned data processing and petroleum operations, as well as a number of smaller companies. People involved in the company's accounting, marketing, and other internal business divisions maintained their own informal, personal contacts for acquiring needed information--thus, the interviewee thought that a Center for STI Transfer offered them no advantages.

The interviewee felt reluctant to answer our questions about the information needs of Agway personnel and suggested that we should discuss the matter with the engineers and managers themselves. He indicated in-house availability to online databases and noted that they frequently contact appropriate government agencies, "research divisions" at SU, or SU and OCPL librarians for assistance. These contacts are maintained through meetings of a professional association. He also noted that that CENTRO and OCPL services were invaluable to the corporation.

As to the question of being an information resource to the proposed STI Transfer Center, Agway would cooperate, as long as the interference with in-house clientele was kept at a manageable level. The greatest stumbling block to a resource-sharing network is the initial and continuing effort it would require to maintain some kind of union list of the holdings of area companies. It was not felt that area companies would be willing or able to offer much assistance in this area, noting that Agway was already hard-pressed to keep up with the required updating to maintain CENTRO's union list of serials. The costs associated with provision of certain types of information were also felt

to be a potential barrier to employees' appreciation of the services the Center could provide.

Carrier Corporation

The interview with representatives at Carrier Corporation, who worked in the library was conducted via the telephone after a number of attempts to arrange a time to meet with them personally. Apparently, they are constantly being contacted by individuals wishing to interview them or discuss R&D. Further, the interviewee was uncertain as to level of managerial commitment and encouragement to participate fully in regional technology transfer and information sharing activities. However, the interviewee noted that Carrier is a founding member of the CASE Center at SU.

It was stressed that Carrier's need for external information links was already sufficiently met through in-house services, the services offered by CENTRO, and by the extensive information resource support network to which they belong as a subsidiary of United Technology. The value for Carrier of establishing closer associations with SU R&D activities was seen as questionable.

The United Technology research center in Connecticut (which they support financially) has a staff of 1000 people doing research in chemistry, heat transfer, and aerodynamics; Carrier is also heavily engaged in its own internal R&D. In the interviewee's opinion, it might be both unnecessary and politically awkward for Carrier to engage in any research efforts with some other organizational entity.

Discussion

It must be kept in mind that at best, these interviews are a first sweep at assessing the STI needs, R&D activities, and perceptions of SU R&D at the larger R&D firms in the Central New York area. Clearly, the people to whom we spoke offered us their frank views which may or may not represent corporate policy and the views of management. Thus, it is difficult to draw conclusions without additional needs assessment, interviews, and internal information audits (Goldhaber, et. al., 1984).

Perhaps most useful, for any follow-up data collection, would be focus group interviews with some of the engineers and R&D managers in these firms. Except in the case of GE, the comments emphasized the library perspective rather than the R&D or scientist' point-of-view. However, it has been documented elsewhere that scientists and engineers are frequently rather naive about the use of STI and management of information resources (Garvey, 1979). However, the information needs of the scientists and engineers and the stance taken by these people would have a major impact for supporting and ignoring a Center for STI Transfer.

The study team was especially impressed with the information resources management approach taken at GE. Due in no small part to the dynamic nature of the staff in the information center, we believe that less education and training would be necessary in this environment regarding the value of STI in innovation and the R&D process than in others. They appear to be most interested in exploring avenues for cooperation and enhancing R&D productivity at GE as well as in joint efforts with SU. Further, we believe that the information center at GE could, with proper managerial involvement, take a leadership stance in the development of a Center for STI Transfer.

LIBRARY COMPONENT

Three data collection activities comprised the library component: pretest interviews, the questionnaire, and the telephone follow-up. As discussed in the previous chapter, the sample was based on academic, special, and public libraries with membership in CENTRO. Generally, this segment of the data collection suggested that while the libraries are very interested in cooperating and participating in a Center, there are numerous concerns about their ability to provide resources in support of such participation.

Pretest Interviews

Semi-structured interviews were conducted with key players in the library community. These conversations resulted in improvements to the questionnaire and also provided important information for resolving the original research questions. The respondents' comments are given below, arranged by topic.

Science Versus Business Information

One area which seems to cause some confusion, particularly in the business community, is the definition of the term "STI." Over the course of the project, several people requested clarification on the difference between "science" and "business" information, the apparent concern being that only science information would be accessible through the proposed Center for STI Transfer.

One respondent offered a description of the difference between the two concepts. Science information includes that material covering basic research in such fields as biology, nursing, chemistry, and engineering. Business

information includes that material which has to do with planning or operating any kind of commercial endeavor. Many of the library collections include material on some interdisciplinary topics which blur the distinction between the two types of information, such as: management (cost-accounting, planning, etc.) of laboratory facilities; computer theory and use (AI, robotics, etc.); and scientific communication.

Role of SU Libraries in STI Transfer

The Science and Technology Library at Syracuse University does not concern itself primarily with the needs of the local business community; its primary mission is to support the basic research, teaching, and coursework needs of Syracuse University science faculty, graduate students, and undergraduates, with its major clientele group being undergraduates. Contact with the business community is very limited.

University researchers are also not extensive users of the science and technology collection. Some come on a regular basis, once a week or once a month, to scan journals relevant to their particular areas of interest. Some call or come in to check specific facts (molecular weights, formulas, etc.). More extensive use is sometimes made of the library by researchers preparing grant proposals (embarking on a literature review, etc.) or beginning a new research project (conducting a search on similar studies, methods, etc.). Some faculty researchers never use the library at all; many engineers are working in a highly specialized or innovative area and rely on colleagues, meetings, etc., to keep abreast of new developments.

Some members of the local business community seek out the business collection at Syracuse University's Bird Library, but the extent of such contact is minimal. This is partly by design. Again, service to this

clientele group is not considered part of the University Libraries' primary mission. Not too many non-university affiliates come into Bird. If recognized as such, and if their requests involve detailed research, they may be referred downtown to the Onondaga County Public Library. If they know, however, that the required information is not available in the Public Library, business people sometimes can be very persistent in their demands for service at Bird.

Representatives from CENTRO and OCPL concurred that there was a great need in the Syracuse area for improving companies' access to business resources and STI. It was noted that both small and large companies share this need. Although the collection at OCPL's main library is most familiar to the local business community, several of the OCPL Branch libraries have developed their own unique clientele groups that would be worth investigating.

Clearly, the business and STI collections at Syracuse University libraries are a major resource in the Central New York region and are largely an untapped resource for local businesses. Currently, SU libraries have neither the mission nor the resources to provide significant direct support in transferring these information resources into the business community.

Possible Roles for Area Libraries in Proposed STI Transfer System

In discussing potential roles with the heads of various libraries and library systems, it became apparent that one important issue would need to be resolved before individual commitments could be expected: what provisions would be made for supplying the libraries with the additional funds and staff that their involvement in such a network would predicate? Interview respondents also stated that, obviously, their libraries could only participate with the approval and direction of their governing bodies.

Discussion on the subject of possible roles for area libraries in the proposed STI transfer network was, therefore, exploratory in nature. Several implicit indications of the respondents' inclinations in this direction surfaced in their recognition of the need for such a network, their reactions to proposed services, etc.

OCPL. The Director of the OCPL system stated his willingness to seriously consider participating in the proposed network. He had no a priori reasons for discounting the idea, and considered area resource sharing programs and good service to all segments of Central New York's population to be intrinsic to OCPL's mission. Further, he recognized the potential impact that the public library could make in the provision of business information and assisting in local economic development.

Syracuse University Libraries. The recently completed extensive self-study program of its operations included recommendations for "Satellite Information Centers ... to provide its users with rapid on-site access to specific information needed to support their research activities," and the institution of fee-based services to the "larger community." The report also mentions that these ventures "can strengthen the alliance between IST [School of Information Studies] and the University Libraries" (Syracuse University Library, 1987). These recommendations, however, are only preliminary; it is impossible to say at this point what course the University Libraries will actually pursue.

During an interview with the Director of the libraries a clear sense of commitment and interest in establishing such a Center was evident. Options were discussed regarding a combined School of Information Studies and Library effort for STI services in the new Science and Technology Center building. Once again, however, concern was voiced over the availability of resources in

support of such efforts. In addition, it was noted that adopting a service mission targeted at the local business community would require careful consideration and discussions with university administration and faculty.

CENTRO. In discussing possible roles for CENTRO, the Director of that organization wanted to make it clear that CENTRO was not obligated to continue its funding beyond the feasibility study phase represented by the current Project. His outlook for CENTRO's place in the proposed network, however, was positive. He suggested that smaller corporate libraries not currently eligible for CENTRO membership could qualify for a new category of membership through the proposed Center, and thus benefit from CENTRO's interlibrary loan program and other resource sharing programs. Further, he indicated that local business and STI resources might be much better leveraged if organized and disseminated through a Center for STI Transfer.

Questionnaires

The questionnaires were scanned by a member of the study team and data from certain key questions were tabulated manually. The total response rate was 56 of 113, or 49.5%. Below is a breakdown of the response rate by type of library:

Business Libraries	9/13	or 69%
Academic Libraries	10/20	or 50%
Special Libraries	2/6	or 33%
OCPL	20/30	or 67%
Mid-York	15/44	or 34%
TOTAL	56/113	or 49.5%

Following is a summary of the library questionnaire results analyzed by type of library.

Business Libraries

Seven of the nine respondents said that their firm engaged in R&D activities. All had in-house collections and access to online databases (one had a homegrown database also); all but one had an in-house librarian or information manager. Only three said they used outside consultants for acquiring STI.

There was no consensus on types of barriers limiting information access. Each cited various factors: lack of time, lack of personnel, too troublesome to identify, etc. Two stated that they encountered no barriers. Only one respondent cited expense or knowing how to acquire the information as a problem.

All but one of the respondents said they contacted outside libraries for STI. The type of contact most often mentioned was interlibrary loan arrangements (CENTRO deemed very useful in all cases). One respondent mentioned contact with OCPL reference and business departments. Another contacted Syracuse University libraries for access to maps and articles, Agway library for access to a Department Head in that company, and a local law firm's information center for regulatory information.

Four respondents said they rarely contacted Syracuse University faculty/staff, and one said they didn't know. Of the four who did contact faculty or staff members at Syracuse University, three cited librarians (all very useful) and only one mentioned "SU faculty as consultants" (very useful). One respondent stressed the value of STI and praised SU library for remote SULIRS access; one noted that seminars on information use would be a good idea.

Regarding respondent's assessment of which services from a proposed Center would be most useful to them, five respondents checked "a database or

directory of key SU research programs," and four checked "customized reports." None checked "scanning of SU R&D activities....," and one checked "access to Central NY STI resources." Budget for their information services was described as two checking \$500-10,000 and the remaining five checked "more than \$10,000."

Academic Libraries

Not surprisingly, meeting the needs of local business people was judged as a moderate to low priority, or not applicable. LeMoyne College and Onondaga Community College seemed to indicate, however, that they welcomed business people nonetheless. In most of the libraries more patrons came from small businesses than large corporations. The number of contacts with patrons from the business community was reported as from 1 or 2 per month to 50 (Utica College) and 300 (SU Science & Technology Library) per month.

In-house collections, ILL, and online databases were the resources most frequently utilized in answering STI questions; least frequently used were outside information services and contacting experts. Moon (the library for SUNY, College of Environmental Sciences and Forestry, Upstate Medical Library, Carrier, GE were indicated by SU Science & Technology librarians as libraries they sometimes refer patrons to; SU's Law Library cited Bird and the Supreme Court Libraries; LeMoyne College Library cited OCPL main library; and Herkimer County Community College cited the Mid-York System.

Basic reference, fact verification, online searching, training information users, and ILL (in other words, traditional library services) were the most frequently offered services. A few libraries, however, also mentioned document delivery, Selective Dissemination of Information, and translation.

All of the respondents checked "they are unaware of our services" as a barrier to providing service to the business community. Four checked "we don't know enough about their needs." Two noted the "lack of cooperation with other libraries." Obtaining additional staff time, financial support, receiving good publicity, and the possibility of promoting local economic development were the incentives for a more active library role in STI transfer.

Public Libraries

A fair number of the respondents remarked specifically that the questionnaire did not seem to apply to them because they were very small libraries in small towns. In almost all cases, the local business community was ranked as a high or moderate priority with public libraries. Local researchers were ranked more often as a lower priority. Small businesses emerged as the greatest source of business patrons.

Mid-York library system (Madison, Oneida, and Herkimer counties) respondents generally did not consider their business and STI collections to be strong. OCPL libraries rated their collections a bit higher. The business collection in the Business and Industry Section of the main OCPL location in downtown Syracuse emerged as by far the most comprehensive and most often used resource. The types of business and STI most frequently sought, listed from most-frequently to least frequently, were:

- o general management
- o computer use and applications
- o statistics
- o accounting and bookkeeping
- o advertising and promotion
- o business law
- o government reports, legislation, and regulations
- o market analysis data
- o patents
- o competitor profiles
- o technical data

The most frequently used resources were in-house collections and ILL. Traditional library services were usually the only ones cited as currently available, and there seemed to be little or no interest in expanding services.

By far, most frequently cited in terms of barriers to providing services was the expense of STI resources. Some libraries checked "we do not know enough about their needs," and "they are unaware of our services." The requirements for improving services, listed from most frequently mentioned to least frequently mentioned were:

- o better business/STI collection
- o more staff
- o new equipment
- o more free staff time
- o more funding (of various kinds)
- o additional staff training
- o new equipment.

The perceived benefits from participating in such a cooperative venture, listed from most frequently mentioned to least frequently mentioned were:

- o positive publicity/increased visibility
- o promoting local economic development
- o increased access to other library collections
- o attracting new clients

Several interesting comments were offered by the responding libraries. OCPL Business and Industrial Section believes that its fine collection is somewhat compromised by lack of staff time, noting that staff have many ideas about how to do a better job. One librarian commented that "The Greater Syracuse Chamber of Commerce could promote use of libraries by local businesses by providing to the libraries one copy of any publication mentioned in their monthly newsletter as well as one copy of each of their publications."

Morrisville Public Library offered some substantive comments on the observed need for, and their desire to offer, information to aid economic development: "Agri-business and small business are both under stress in rural

Madison County. Their "need-to-know" has never been greater. Neither is comfortable with the information-searching process. We could increase their access to the universe of resources available in a non-threatening setting if we had the material to do so."

Discussion

Proposed Services. All of the interview respondents reacted favorably to our draft of proposed services (finalized as Figure 3 in Chapter 5), and a few added suggestions of their own. Several librarians stated that one useful service would be an index for local newspapers. This is frequently needed by the business community, but accessing this valuable source of information on local businesses and business-related events is almost impossible.

Another service suggested by those interview respondents who dealt extensively with the business community was the establishment of a new position, the "circuit-riding business librarian," to help small businesses identify and resolve their information needs. This service would be modeled after the agricultural extension service and would place information management assistance in the business rather than expecting businesspeople to come to the library.

One respondent took a broad view of possible services, stating that a network that would improve communications and access among area libraries, researchers, and the business community was obviously needed and that substantial benefits could be gained by several low-tech mechanisms that would be relatively easy to implement (e.g., a local research resource inventory, regional cooperation in interlibrary loan and document delivery, better relations between Syracuse University Libraries and the rest of the community).

Interlibrary Cooperation. Currently, the strongest links for cooperation among libraries exist within an individual library system or are due to the influence of CENTRO. Contacts between librarians at different types of institutions seem to be informal and occasional. Staff at the public library will sometimes refer patrons to Bird if they know it has the particular journal title requested and, as previously noted, staff at Bird will frequently refer individuals not associated with the University to the public library. The staff from some corporate information centers will on occasion call either the public library or the University Libraries for information unavailable in their own collections. However, referring a patron from one library to another is not provision of information and often serves primarily as a frustration for the user.

Concerns of Area Libraries. Some of the respondents expressed concerns about the proposed Center for STI Transfer. A few of the concerns were quite specific. One librarian mentioned that the name eventually chosen for a Center should make it clear to users that it is not located in the Syracuse University Libraries, remarking that they do not want to have to handle all the "wrong numbers." A warning was also offered on the need to have a clearly articulated policy regarding the student population. It was asserted that once the students found out about the center, they would descend in droves. Several respondents noted that the issue of charging fees for services could be problematical. A number of the public libraries are adamantly opposed to fees being levied for information services.

Other comments were more general in nature. The problem of political squabbles and "turf protection" was mentioned by several of those interviewed. This has apparently stymied a few previous efforts aimed at cooperative ventures. One reason for this problem is the natural inclination for each library to protect its own programs as a magnet for funding.

Several librarians and administrators noted that the STI transfer versus the technology transfer distinction seemed a bit slippery. They wondered whether the center would be "just another fee-based academic library service" and, if not, how the technology transfer aspect could be integrated into the Center. One librarian wondered if the services proposed for the STI transfer center would conflict or overlap with those offered by existing offices on the Syracuse University campus.

Several of the respondents expressed a considerable amount of concern regarding project recommendations. They had previously been in the situation where an outside group and top administrators of the parent organization had agreed--without substantial input from those who would eventually feel the greatest impact--to implement some scheme for a new service or program. The result was that the library was expected to participate without receiving any additional support, resources, staff, etc.

Phone Follow-Up

Although the return rate for the library component was acceptable, we decided to call about 20% of the library non-respondents to discover why they did not return the questionnaires and obtain additional information related to the questions contained on the questionnaire. Additional description of the process used to complete this task is given above in the Business Component of this chapter.

The response rate was lowest for libraries in the Mid-York System (27%). Several of the Mid-York respondents indicated that they did not feel that the questionnaire pertained to them because they were so small and, therefore, they did not really attempt to address business and research information

needs. We assumed that this same attitude might have accounted for non-response among a number of the smaller public libraries in the region.

Among the non-respondents, a broad range of reasons were put forward for not having completed and returned the questionnaire: in one setting all library mail is sent to the main library rather than the individual library, one said the person it was addressed to was on vacation so it was probably tossed, some addressees had changed jobs, a number indicated that the questionnaire said it did not apply to their small library so they tossed it, another indicated that they were too busy to complete the questionnaire, others said they had received the questionnaire and promised to return it, and one indicated that it was against policy to answer questionnaires without special clearance.

As a result of the telephone follow-up, the study team concluded that the library population in the Central New York region can be categorized into two basic groups regarding interest in a proposed Center for STI Transfer. The first category tends to be those larger libraries in settings with some existing business clientele and have a broad perspective on provision of information services. The second group is comprised of smaller libraries that either have minimal contact with the business community or believe it inappropriate to expand existing contact given limited resources. It is likely that the majority of the questionnaire respondents comprised membership in the first-mentioned group.

SYRACUSE UNIVERSITY COMPONENT

Most of the Syracuse University officials interviewed did not see that there was yet a large proportion of the total amount of Syracuse research given over to "applications-oriented" work at the present time. Historically, very few Universities in the United States have had this mission as a priority and faculty typically are not rewarded or encouraged for strengthening connections with local businesses.

However, there was a strong belief on the part of almost all those to whom we spoke, that SU is currently going through a transition period. There is a feeling that institutions of higher learning must be responsive to the needs of the communities which surround them, and which support them. This trend in thinking has taken the form of increased attention to fostering University-Industry cooperation for local area development, and increased support of research showing potential for local commercialization.

Several Organized Research Units (ORU's) recently have been established at SU which have shown direct interest in research for local commercialization, and produced tangible proof of that interest. Other ORU's have clear potential for creating commercial products, industrial processes, and useful business techniques.

The University has several tools to work with in its effort to enhance local area economic development. Among these tools are SU faculty, Libraries, a strong research track record, success in attracting major research projects to the campus, and excellent computing facilities. Despite these resources, the findings suggest that they have not been marshaled and coordinated successfully for STI/technology transfer.

Organized Research Units (ORU's)

This section of chapter offers an overview of some of the major research unit activities on campus. The listing is not comprehensive, but rather, is intended to be representative of selected areas where there could be mutual benefits derived from increased contact between SU and regional businesses, or for attracting external business community interest.

CASE Center

The principal unit currently involved in research and development activities with high potential to support local economic development is the Center for Computer Applications and Software Engineering (CASE). The CASE Center is dedicated to technology transfer activities such as:

- o funding and supporting computer and applications research for direct export to the community
- o encouraging the "incubation" of new businesses
- o offering courses for continuing education and for retraining of working people in the local area and throughout New York State
- o distributing a monthly Newsletter of Technology Transfer activities
- o organizing conferences and seminars of interest to local businessmen
- o offering opportunities for researchers from the private sector to work with advanced computer technologies.

The Center offers a packet of materials on their activities which can be acquired by any interested parties by contacting: Communications Manager, CASE Center, 120 Hinds Hall, Syracuse University, Syracuse, NY 13244. Examples of research topics currently funded at the CASE Center are:

- o Improving the Performance of Logic Programming Systems, by J. Oldfield, sponsored by IBM.
- o Machines for Associative Computation (SUMAC) Transputer Project, by Brad Strait and Charles Stormon, sponsored by INMOS.
- o IBM Academic Information Systems Research, by Brad Strait, sponsored by IBM.
- o Artificial Intelligence Research, by Brad Strait, sponsored by General Electric.
- o Interdisciplinary Research to Apply Computer-enhanced Expert Techniques, by Brad Strait, sponsored by Niagara Mohawk.
- o Artificial Intelligence Consortium, by V. Weiss, sponsored by Rome Air Development Center.

These and other projects have potential applications from commercialization and product development. The Case Center maintains a list of in-house reports summarizing selected funded research projects.

SUPAC

The Syracuse University Parallel Architectures Center (SUPAC) was launched in the Spring of 1987 with a 12 million dollar grant from the Office of Naval Research. SUPAC is headed by the former Executive Director and co-founder of the Cornell University Center for Theory and Simulation in Science and Engineering--a national supercomputer facility. He is also the co-founder of the New York State Education and Research Network (NYSERNET) ("Syracuse Establishes Parallel Architecture Computing Center," 1987).

SUPAC will undoubtedly contribute greatly to the richness of Syracuse University research, since it is intended to be both a basic and applied research facility in the expanding field of parallel computing. As a national

testing and assessment facility for parallel architecture numerous spin-off developments may occur if high quality STI/technology transfer mechanisms are put in place. As yet, however, the Center has only just been established and applications for business development and impact on the local economy can be expected in the future.

Center for Membrane Engineering and Science

This Center is the nation's first in the area, and as such represents an enormous opportunity for Central New York. Membranes are selectively permeable barriers--plant membranes, for example allow nutrients to the cell but block harmful substances. The Center will have an educational division, and industrial cooperation support unit, a research programs unit, and a "management system to oversee the Center and serve as a liaison among industry, government, and the university." The new director of the Center "estimates that the membranes industry, based on existing technology, will grow by a at least 10% annually from the current \$10 billion in sales."

One application of selectively permeable membranes is the reduction of toxic products in the environment. Other possible uses include "controlled release of drugs, insecticides and herbicides, microelectronics and bio-chip inspired integrated circuits, containers, and biomedical devices such as blood oxygenators" ("Syracuse Opens Nation's First Center...", 1987). Independent interview data confirmed the excitement over this new Center as a research resource.

Institute for Sensory Research

The Institute is devoted to advanced, multidisciplinary study of the structure and function of human and animal sensory systems including the peripheral organs, nerves, and brain. The Institute is located at the University's Skytop campus. It conducts research in the transmission of sensory stimuli such as light, sound, and their translation into nerve impulses; with information processing into the peripheral nervous system and the brain; and with the relationships between sensory stimuli and the sensations and perceptions they produce. Again, interview data showed that this Institute is highly regarded as a research resource.

Kellogg Project

This project is best thought of as an organized research unit, as it involves the work of many participants collaborating over an extended period in a single area. The purpose of the project is to allow for worldwide electronic access to a vast archive of education materials. The Project is funded by a \$3.7 million grant from the Kellogg Foundation and involves extensive work in computer archiving and information retrieval; optical digital disk technology; and knowledge representation. The Project is directed by the School of Education and has direct involvement of faculty and staff from the University Library and the School of Information Studies.

The project eventually will design an optical disk system to store the equivalent of 65 million pages of text including photographs. The project has acknowledged potential for developmental spin-offs in many areas such as indexing techniques, telecommunications networking, compact storage and access to information resources, and preservation ("Optical Disks are Nucleus of Network Funded by Grant," 1986).

Other Organized Research Units

The following units also were identified as being of great importance to the attractiveness of Syracuse University as a research and consulting resource:

- o The Solid State Science and Technology Program of the College of Engineering.
- o The Institute for Energy research, also connected to the College of Engineering.
- o The Belfer Audio Laboratory.
- o The Center for Hazardous Waste Assessment, Remediation and Management
- o The Technology and Information Policy Program.

There may be additional ORUs on campus but the study team was unable to locate one single comprehensive listing for such units.

Representative Current Funded Projects

Syracuse University currently receives between 500 and 600 awards for research per year and in 1986 received \$33.5 million in research funds. Based on past performance, this figure can be expected to continue to rise at a steady rate. The ratio of submitted proposals to funded proposals is excellent--60%. In a recent survey by the National Science Foundation, Syracuse was ranked in the top 100 research Universities in the country for receipt of Federal research monies. According to the Vice President for Research and Graduate Studies at Syracuse University, this survey did not include 26% of SU research support which comes to the University from the private sector ("Syracuse Ranked in the Top 100 Among Research Institutions," 1987).

A sample of recently funded projects was taken to highlight the kinds of research undertaken at Syracuse. The examples were chosen for their diversity and for their potential for commercial applications. Appendix C offers a list of such research and is based on information provided by interviewees, a computer print-out of recent funded projects available from the SU Office of Sponsored Programs (Syracuse University, 1987), and with the assistance of various Syracuse University officials. It is intended to be indicative of the University's current capabilities, but in no way covers the gamut of University research with potential for commercial development.

It should also be stressed that many SU Faculty are engaged in research activities which, although not supported by external funding, could have potential for commercialization, product development, or otherwise be of interest to the business community. Our study made no attempt to identify such research endeavors but clearly, this area deserves additional investigation if a comprehensive picture of SU research resources is to be obtained.

Departments and Subject Areas

The last portion of the research inventory attempted to identify those academic departments which might be considered first targets for the information dissemination activities of a Center for STI Transfer. These units were determined by informal assessment among interviewees and by examination of printed indexes such as the Institute for Scientific Information's Science Citation Index, and Social Science Citation Index:

- o Department of Chemistry: Multinuclei NMR and Data Processing, membrane research
- o School of Computer and Information Science: Logic Programming, Decoding Theory and Techniques
- o Maxwell School of Citizenship and Public Affairs Metropolitan Studies Dept.: Urban Planning, and Taxation Studies
- o Department of Physics: Particle Physics, and Electromagnetics, Surface Physics, and Semiconductors
- o L.C. Smith College of Engineering
- o Dept. of Chemical Engineering and Materials Science
- o Dept. of Civil Engineering: Structural Mechanics, Geotechnical Engineering, fluid mechanics
- o Dept. of Electrical and Computing Engineering: Solid State Science and Technology
- o Dept. of Industrial Engineering and Operations Research
- o Dept. of Mechanical and Aerospace Engineering: Combustion Processes, Robotics Dynamics and Control
- o School of Information Studies: artificial intelligence, information retrieval systems, information management
- o Heroy Geology Laboratory
- o Belfer Audio Laboratory: Signal Processing, Laser Reproduction, Sound Digitizing
- o School of Education: Instructional Design, Educational Technologies including Optical Disks
- o Dept. of Geography
- o Design Dept.: Interior and Industrial Design
- o School of Management
- o Dept. of Biology
- o Biology Research Laboratory

Once again, we caution that this list is only a first sweep and that undoubtedly, some very productive research units on campus have inadvertently been excluded. The lack of centralized listings of faculty and departmental research activities compounds the difficulty in developing such a list. Additional investigation is necessary to better identify those campus units and individuals engaged in research with high potential for commercialization and product development.

NYSERNET

The New York State Education and Research Network (NYSERNET) is a high speed communications network capable of connecting supercomputers, Universities, and private research laboratories across New York State.

According to reports, this network link will allow for the connection of all the New York Centers for Advanced Technology, of which the Syracuse University CASE Center is one. The network will also allow for remote access to the Library holdings of major research Libraries throughout the State. Generally, there are three main uses for NYSERNET:

- o as a state-wide electronic mail network to other businesses and academic institutions
- o as a fast data transfer link; currently six times faster than the most commonly used research data transfer link (BITNET), and soon to be approximately 150 times faster BITNET
- o as a tool for remote access of computing facilities participating in the network.

The implications of the Network for STI transfer between universities and the private sector are exciting ("NYSERNET to Link 14 Universities in New York State," 1986).

However, specific applications in this area are still in the developmental stage. Nonetheless, possible uses in the context of STI transfer include:

- o facilitating joint research projects between universities and private sector firms
- o allowing rapid and reliable data transmission of large files for remote site analysis
- o coordinating computer conferencing and electronic mail services among universities and firms interested in specific areas of technology transfer
- o providing remote site educational opportunities.

A design for the proposed Center for STI Transfer would have to consider these and other applications. However, use of NYSERNET in STI/technology transfer at SU and for Central New York economic development would have to be preceded by resolving a number of other issues and concerns which are identified in Chapter 5.

Discussion

As a result of these interviews and the research inventory, several key issues have been made known to University officials. One of the most important results is that key SU officials are now aware of the need for more coordination and planning for SU STI dissemination. They see that improved STI management and dissemination activities would yield useful benefits to both the University and the region. Also, several of the officials indicated a desire to cooperate and assist in the design of activities for the proposed Center--allowing for the resolution of a number of structural and administrative options.

The beginnings of a comprehensive SU research resources database in the Office of Sponsored Programs might form as the nucleus of the proposed Center's Research Resource database. This office has a listing of research projects currently funded by outside agencies. The data include project titles, principal investigator(s), funding agencies, and an abstract of the the project. The comprehensiveness and suitability of this system to facilitate STI/technology transfer is uncertain without additional investigation. But a sense of the magnitude of the tasks involved in developing a current comprehensive database of SU research resources has been acquired.

These findings suggest the immediate basis and potential role of Syracuse University as a substantial contributor to the "knowledge base" of the region in terms of both applications-oriented research and disseminating business/STI. But generally, the University has yet to market and promote its research resources to specific target audiences; it has yet to coordinate, university-wide, efforts for STI/technology transfer; and it has yet to obtain maximum leverage from existing research resources by managing the resultant STI.

OTHER KEY STAKEHOLDERS

In the course of the study it became apparent that there are other key producers and consumers of research in the local area whose perspectives would be extremely valuable with regard to establishing a Center for STI Transfer. These other stakeholders include the Rome Air Development Center (RADC), SUNY College of Environmental Sciences and Forestry, the various medical research facilities in the Greater Syracuse area, and other local corporations that are engaged in formalized R&D.

Rome Air Development Center (RADC)

RADC is located in Rome, New York, and is associated with Griffiss Air Force Base. It includes the Data & Analysis Center for Software which has the following functions (National Technical Information Service, 1986, pp. 77-78):

- o develop and maintain a computer database of empirical data regarding the development and maintenance of computer software
- o produce and distribute subsets of that database
- o maintain software technology information base of technical documents, project status information, and evaluation data

- o analyze the data and information and produce technical reports
- o maintain a current awareness program which will include the dissemination of technical information.

And it also includes the Reliability Analysis Center whose functions are to serve as a focal point for the recovery of reliability test data and experience information on microcircuit and related component parts for a range of defense systems (ibid., p. 91). One might assume that a broad range of additional research activities are in place at RADC, however, the study team did not obtain additional information about such activities.

We met with a representative from RADC who had several constructive suggestions for the project, but was unable to confirm any specific level of cooperation that might be possible between RADC and the proposed Center. He suggested that such decisions would have to be made at higher administrative levels. In general, the suggestions centered on the need to expand the scope of the project to include more activities concerned with direct "technology transfer," and to take a "top-down approach" (i.e., start with top administrators first) to obtain cooperation from key players.

RADC was acknowledged to be a major producer of research in the Central New York region. The rationale for RADC to engage in technology transfer and STI transfer has apparently never been clearly articulated although they are expected to meet certain Federal requirements for encouraging the transfer of STI and technology into the private sector (i.e., the Stevenson-Wydler Act and Executive Order 12581, "Facilitating Access to Science and Technology").

It was noted that evidence of successful STI/technology transfer programs among Federal labs, armed services R&D facilities, and universities elsewhere could be documented and investigated as possible role models. The cooperative program between Wright-Patterson Air Force Base and Ohio State University was

offered as a possible model to be examined. Clearly, exploration of possible cooperation for STI/technology transfer among RADC, Syracuse University, local businesses, and other interested parties should be undertaken.

SUNY College of Environmental Sciences and Forestry

We also met with an administrator from SUNY-ESF. The interview was most useful as it provided specific information on current research initiatives at ESF. Specifically, the SUNY system "Research and Graduate Study Initiative" can be expected to add to the College's strengths in four targeted areas:

- o biotechnology in forestry: chemical ecology, plant genetics, cloning, and biotransformations
- o process engineering: fiber and paper physics, composite materials science, pulping, and pollution abatement
- o environmental systems science: ecosystems dynamics, land use change, pollution, and optimization of energy processing in ecological systems
- o polymer science and technology: permeation of gases through polymer films, crystal structures, ion binding, elasticity of polymer networks, and high flux membranes.

The college has a number of ORUs including the Cellulose Research Institute, the Polymer Research Institute, the Empire State Paper Research Institute, and the Northeast Petroleum-Forest Resources Cooperative. A review of the college's Current Research Directory, (1986) which provides a listing of funded research projects, including summary abstracts, offers a more detailed view of the research initiatives at ESF.

At times, it seems, ESF is hidden by the presence of SU and local businesses tend to link the two together, somehow, as "all part of SU." Special attention should be given to coordinating the STI/technology transfer

process of ESF with that of the proposed Center for STI Transfer--especially since the the vast majority of ESF research is "applications-oriented." Clearly, the design of a Center for STI Transfer would profit immeasurably by the direct participation and involvement of ESF--a key player in Central New York R&D.

Discussion

The above interviews clearly indicate the importance of RADC and SUNY-ESF in any Central New York Center for STI Transfer. In addition, the study team suspects that there is a wide range of medical research and research resources in the area and especially with regard to the SUNY Health Science Center at Syracuse. Further, it is likely that there are additional private sector firms engaged in R&D which have not been identified as part of the Central New York research infrastructure. Additional investigation is needed to describe their research resources, determine the degree to which they produce R&D with the potential for commercial application/spin-offs, and explore possible means by which they might formally participate in a Center for STI Transfer.

SUMMARY FINDINGS

This section provides an overview of major findings as a result of the various data collection activities. As suggested in the above text, some of these findings should best be termed as "preliminary findings" until additional investigations and data collection can be accomplished.

Business Component

- o Many firms have minimal appreciation for the value of information resources nor are they aware of the types of business and STI are available. Thus, one should not be surprised that they find it difficult to articulate their business and STI needs.
- o Many firms could profit from some educational programs and training seminars related to information management.
- o Virtually all of the firms in the region could profit by better access to and use of business information, a much smaller group would profit by access to and use of SU or other STI.
- o Of those companies that said they did not perform R&D many contacted outside consultants and used local libraries to obtain information.
- o Almost all of the contacts with SU faculty and staff were made through personal acquaintance and were judged to be very useful.
- o The three barriers to obtaining STI most often cited by small businesses were that STI was too expensive to obtain, that they could not determine if needed information is available, and they did not know how to acquire it. This finding is confirmed by other studies (King Research, 1985) which state that small businesses confront numerous economic barrier in accessing STI, are ignorant about STI, and where to get it.
- o The two most desired services from a Center for STI Transfer were customized reports on a company's special interests and a database of key SU research resources.
- o Some companies stated implicitly or explicitly in the comments section of the questionnaire that people who are knowledgeable and informed in both the science and information fields are needed to act as an interface between them and the larger information infrastructure.

- o Many companies seem to feel that there is a lack of up-to-date technical information in their local public libraries.
- o Uses of a Center for STI Transfer by regional businesses would vary considerably depending on the activities and mission of the firm, its existing level of sophistication with principles of information resources management, and the degree to which they need "business information" as opposed to STI.
- o While SU enjoys high credibility in the region as a quality educational institution, it suffers from a poor image in terms of the degree to which it is committed to working locally in the region on projects that might benefit the region as a whole.

Library Component

- o Excellent information resources/services currently are available through the Business and Industry Section at the OCPL main library in downtown Syracuse, SU's Science and Technology Library, and CENTRO's interlibrary loan program.
- o Most area libraries do not have the staff time or financial resources to provide a high level of service to the business and research communities--even if they consider this user group as a high priority. Realistically, only very limited direct involvement by the library community could be expected initially in the operation of a Center for STI Transfer.
- o There seems to be more of a tradition of cooperation among libraries of the same type than among different types, e.g., public libraries with other public libraries as opposed to public libraries with academic libraries.

- o The CENTRO and OCPL Directors seem most concerned with the need to better assist area business people and R&D firms resolve their information needs and are eager to address the situation. They also noted, however, the need to be aware of possible political entanglements.
- o Some librarians seem nervous about being asked to participate in a project for which they have not had a chance to offer much input, are not receiving adequate support, or can not perceive any great benefit for themselves, their institutions, or their main users.
- o Librarians tended to focus on resources as the major inducement for participation in the proposed Center for STI Transfer rather than the possibility of attracting new clients, or the probability of aiding local economic development.
- o Initiating a few simple services could greatly improve and facilitate library cooperative efforts in STI transfer for regional economic development (e.g., the provision of business and R&D directories; a more formalized means of communication among librarians in different organizations and among librarians, information seekers, and STI providers; interlibrary loan capabilities for smaller libraries; and easier access to Syracuse University research resources, facilities, and Faculty).
- o Without clear and tangible incentives, public libraries are not inclined to charge fees and academic and corporate libraries are not inclined to throw open their doors to "hordes of outsiders".

Syracuse University Component

- o There is a wide agreement among key players at SU that a Center for STI Transfer or Technology Transfer is not only feasible, but an important activity to accompany SU's increased role as a major research institution.

- o SU efforts in STI/technology transfer have rested on decentralized and uncoordinated activities among the CASE Center, informal transfer by individual faculty, two or three research-oriented Institutes, and knowledge transfer through curriculum offerings designed especially for the professional community.
- o There is little formal effort made to promote, disseminate, and transfer SU research and resulting STI to the private sector in general, or specifically to the Central New York region.
- o Direct involvement by the Rome Air Development Center (RADC) and SUNY College of Environmental Sciences and Forestry (among other possible players) would add significantly to the strength of the proposed Center for STI Transfer.
- o There are a number of units on the Syracuse University campus that are "involved" in and/or knowledgeable about STI/technology transfer or would like to be more involved in such activities. However, there is limited central coordination of these various units and activities.
- o A number of people contacted agree that a successful STI/technology transfer program here in Central New York can take the best from projects already operational elsewhere.
- o Creation and maintenance of a University-wide database of research expertise and actual research efforts will be difficult, though not impossible to handle through direct faculty solicitation. A foundation for such an effort exists in the Office of Sponsored Programs and in the Office for Research Development and Special Projects.

- o There is general agreement that currently, a small proportion of research performed at SU can be clearly seen as having applications for commercialization, product development, or otherwise of interest to Central New York businesses. But equally, there is wide-spread belief that that proportion will rise dramatically in the immediate future with such initiatives as the CASE Center, SUPAC, and the new Science and Technology Center.

These findings offer a systems perspective on key players in the Central New York region regarding the production and use of business and STI. Although there are differing views about specific issues (which will be discussed in the next chapter), there is general agreement that a successful program for regional STI/technology management is "long overdue." The next chapter offers ideas and recommendations for initiating such a program.

NOTES

1. SULIRS is the name of the Syracuse University Library online catalog. This catalog contains the vast majority of the library's holdings and is accessible to the local community via relatively inexpensive computer and telecommunications equipment.
2. Syracuse University, School of Education and School of Information Studies, jointly operate the Clearinghouse on Information Resource supported, in part, by U.S. Department of Education. The Clearinghouse acquires and places into its online database, ERIC, a wide range of information sources related to education, information science, educational technology, etc.
3. 10K reports are annual reports that all U.S. corporations with publicly traded stock are required to file with the Securities and Exchange Commission (SEC). Frequently they contain more detailed information than in the company's annual report.
4. Additional information about classification of federal R&D can be found in Walter R. Blados, "Controlling Unclassified Scientific and Technical Information," Information Management Review 2 (Spring 1987): 49-60; information describing the impact of export controls on U.S. technology development and access to STI is available in Balancing the National Interest: U.S. National Security Controls and Global Economic Competition (Washington, D.C.: National Academy Press, 1987).

CHAPTER 5

REALIZATION OF A CENTER FOR STI TRANSFER

This project reviewed a broad range of data sources and identified a number of topics and issues that affect the feasibility of establishing a Center for STI Transfer. While there is a sense of excitement and broad support for establishing such a Center, there are numerous issues and concerns that will have to be addressed if such a Center is to be realized. Additional discussion of these conclusions and recommendations among the key stakeholders will increase the likelihood that such a Center is successful.

The purpose of this chapter is to provide an overview of key conclusions; describe possible missions, services and structures for the Center for STI Transfer; and to offer recommendations related to the establishment of a Center for STI Transfer. These conclusions and recommendations are based on both the information reported in the previous chapters and the study team's assessment of more intangible factors such as attitudes and perceptions of individuals who were interviewed and contacted as part of the study.

CONCLUSIONS

One conclusion from the project is that there is general agreement among all stakeholders as to the importance and need for such a Center. There is growing recognition in the Central New York region that Syracuse University and the local community must better coordinate their resources for local economic development. The University, the business community, and the library community appear poised to address issues related to management of STI to encourage local economic development.

The strategy of establishing a Center for STI Transfer would require significant coordination among a broad range of stakeholders. However, the pay-back for local economic development appears to be significant. Listed below are key conclusions regarding the feasibility of such a Center and issues that must be considered if a Center is to be established successfully.

Confusion Between Technology Transfer and Transfer of STI

The data collection activities identified some confusion among stakeholders as to the primary "business" for such a center. The study team believes that technology transfer and STI transfer are often different processes. Generally, STI transfer is a necessary, but not sufficient, condition that must be in place before successful technology transfer can occur. Some interviewees would prefer that the establishment of any Center at SU be focused on technology transfer but appear to either ignore or be unaware of the fact that an information infrastructure is essential to support a successful technology transfer process.

The purpose of this project was to determine the feasibility for a Center for the transfer of science and technological information. Such a center's primary activities would focus on the management of STI as opposed to the management of technology transfer. While it certainly is possible that the two roles can be woven together in a single administrative unit, key stakeholders at the University and the business community need to recognize the differences between a center whose mission is supporting technology transfer, versus a center for the management and transfer of STI.

Confusion Between STI and Business Information

STI has been defined as the results from formalized research and development activities. STI may be the result of basic or applied research and may or may not have immediate utility or application for the business community. Such results may take the form of scholarly reports or informal communication. Business information is a generic term that represents an expanse of published information resources that can assist businesspeople make strategic and day-to-day tactical decisions. An example of business information being a competitors' market share for a particular product. The term business information--as used in this report--is not the direct result of formalized R&D activities.

The primary products from R&D done at SU can best be labeled as STI. Some of these may have the potential for development and application in the business community for refining or creating new commercial products. But generally, SU R&D produces STI, not business information. Nonetheless, both STI and business information have the potential to enhance local economic development--but they do not constitute the same type of information resource.

Economic development for many Central New York businesses can be enhanced by better access to and use of business information and that portion of STI that emphasizes the technology component. While the STI from SU and other sources may assist a handful of area firms that actively engage in R&D, enhanced economic development for many firms depends on better access to and use of business and technical information.

Generally, larger firms with R&D labs, or emerging firms heavily dependent on new technology, could benefit from a Center for STI Transfer and closer contact with SU researchers. But many firms simply require better access to and use of a broad range of business information and general

consultation with selected SU faculty. In short, a Center for STI Transfer would have to carefully determine the degree to which it would also be involved in the transfer of business information.

Understanding Information Resources Management (IRM) Techniques

Establishing a center that significantly improves the access to STI and business information in the local business community will not, in and of itself, affect local economic development. Firms must know enough to realize that they have an information need, recognize the importance of information as a corporate resource, and be organized to manage that information in the decision making process (Marchand and Horton, 1986).

Our interviews and on-site visits suggest that many firms do not understand basic principles of IRM and are not organized to exploit available information resources for decision making. In a small local firm, respondents told us that when information was needed, they reviewed the back issues of various trade journals and "hoped to find an answer."

In a very large firm's R&D lab there is no organized method by which researchers can identify and be supplied with STI--they must fend for themselves. In short, notions of "information management" and "management of information resources" are not well understood. Thus, there is a significant educational problem in the local business community regarding information resources and their role in decision making that will require the attention of any center for STI or technology transfer.

Similar confusion exists within SU. Interviews with a number of officials and faculty on campus suggests that there is a broad range of opinion about how information is transferred for technology development and encouragement of innovation. Generally, however, there are few information

professionals actively involved in such activities and very traditional mechanisms, such as newsletters, are relied upon as a transfer agent.

Further, the lack of a comprehensive "SU Research Resources Database" is evidence of the University's inability to manage its own research activities. Discussions with a number of campus officials and faculty uncovered in-house research reports and other "gray literature" which lacks bibliographic control and access mechanisms either within the University or by members of the business community. In short, there may be much research activity occurring on campus which is unknown except within the actual project team. Generally, SU research activities need to be accessed and promoted to the larger R&D community. Principles of IRM can find a home in the management of SU research resources as well as in the business community.

Central New York STI and Business Information Resources

Successful regional economic development and technology transfer into the local business community require many conditions to be in place. However, a key, but often overlooked, factor is the information infrastructure of the region. In the Central New York region, the key players in providing this infrastructure are:

- o Onondaga County Public Library (OCPL): the library has committed resources to developing and maintaining a solid collection of business and information resources and will enhance those collections and services when they move into their new facilities
- o Syracuse University: the scientific and technical information resources in the libraries are extensive; individual expertise of faculty are a major resource

- o Utica Public Library: this library, the central library for the Mid York Library System, was mentioned by a number of individuals for its business information resources; some termed these as "modest" but the library serves an important Central New York region that cannot easily obtain direct access to Syracuse area information resources
- o Central NY Library Resources Council (CENTRO): provides a support system of interlibrary loan and resource sharing among some 300 libraries in the Central NY region.

Clearly, other collections of STI and business information are located in various companies or other agencies. However, these four institutions are the key players for direct access to local STI and business information resources.

This infrastructure represents only the local one. Through these institutions as well as other mechanisms, access to a world of STI and business information can be provided. Some of this "external" information infrastructure is available free of charge to local businesses or for modest fees through local public libraries. Generally, however, local STI and business information resources are inadequate for direct local economic development without significant and heavy reliance on the larger external information infrastructure.

But the local information infrastructure is based on more than collections of materials and databases. At this time, library staffing generally (both at SU and the local public libraries) and, more specifically, the availability of professional librarians and information resource managers in the region, is inadequate to support the information demands of the business community (assuming that the business community became aware of their needs and engaged information professionals to resolve them). Indeed, some comments from the library community indicated that in the near future, steps

may have to be taken to restrict the use of some information services because of limited resources.

Inadequate Regional Planning

While there is broad-based support and encouragement for establishing some form of a Center for STI/Technology Transfer, there are a host of players suggesting a range of gambits to deal with the issue. Generally, the players can be categorized as being affiliated with Syracuse University or with the local government/private sector.

At Syracuse University, a number of departments, organized research units, and administrative offices claim some involvement, activities, and approaches for coordinating SU activities related to:

- o local economic development
- o technology transfer
- o STI transfer.

In some instances, as a result of this study, claimants were surprised to find others on campus who were actively involved in one of more of the above.

On the government/private side of the equation, one also finds a large field of players. The Greater Syracuse Chamber of Commerce certainly has a key role here, but so too do individual corporations, Economic Development Centers in BOCES units, the Central NY Technology Development Organization, the city of Syracuse and local county governmental units, and so forth.

Interestingly, there is some sentiment on the part of the government/private sector that development of such a Center is primarily the responsibility of SU and that SU needs to take the lead in this area. However, coordinated efforts among key stakeholders in the private and government sectors throughout the region are also in need of a comprehensive

approach. There is minimal communication among the larger corporations with smaller, newly established firms; some local governmental units appear to be relatively uninformed as to library and other information services in the region; ongoing communication between local governmental units and Syracuse University administration can be improved; and there are numerous agencies who are "involved" in regional economic development.

Squabbles, however, over which particular individual or agency is responsible for the current situation or should take the lead in future efforts, are non-productive. At this time, the unmistakable conclusion is that a lack of coordinated planning exists at three different levels:

- o among regional government/private sector agencies
- o within Syracuse University
- o between SU and regional governmental/private agencies.

Successful strategies for STI/technology transfer in the Central New York region are not likely to occur until coordinated planning activities take place at each of these three levels by top level administrators, directors, and CEOs.

Identification of Follow-Up Funding Sources

Part of the project was aimed at identifying potential funding sources for the possible implementation of a Center. While the study concludes that establishment of such a Center is, in fact, feasible, it also concludes that significant additional planning and coordination for the design of such a Center is necessary. Before a proposal for implementation is likely to be positively received by a funding agency key issues must be resolved (see recommendations section later in this chapter).

Thus, the study team approached a number of potential funding agencies, but in the context of obtaining resources for a design phase. Minimally, such a phase will require 5-8 months after completion of this feasibility study. After careful review of available funding opportunities a proposal was submitted to the New York State Science and Technology Foundation requesting \$45,000 for the period September, 1987 - January, 1988.

The proposal has as its objective the production of an operational design for a Center of STI Transfer at Syracuse University. The success of the proposal is uncertain. In the view of the study team, it is likely that local resources from regional stakeholders may be necessary to produce such a design. That design project, then, could serve as a vehicle for submitting a proposal to an appropriate funding agency for monies to establish and implement a center.

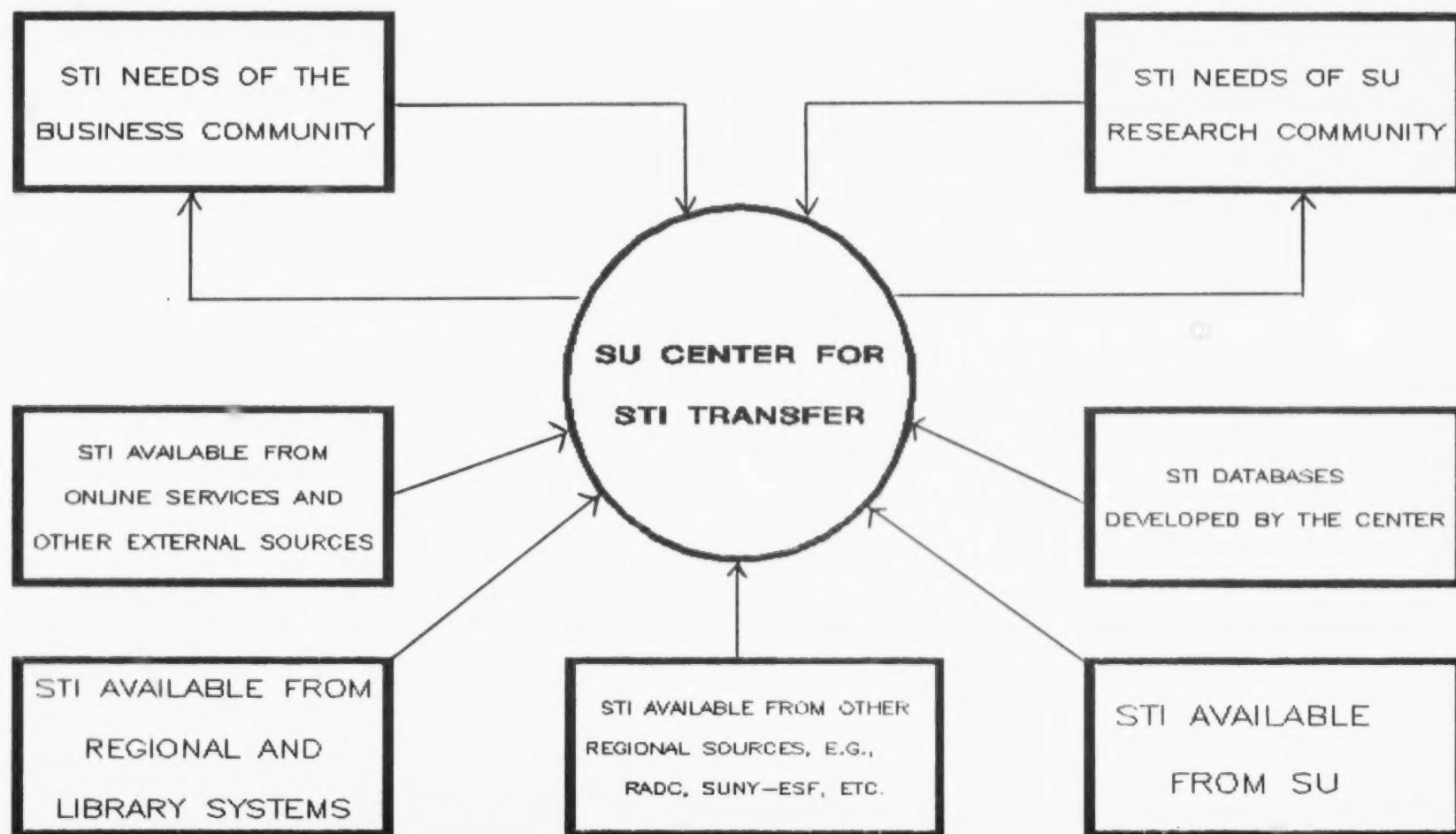
A SU CENTER FOR STI TRANSFER: POSSIBLE APPROACHES

A key component of this project was to explore possible administrative structures and services for a Center for STI Transfer. A SU Center for STI Transfer can play a critical role encouraging regional economic development by serving as a focal point to coordinate the collection and use of information resources, to integrate business and research information services, and to facilitate the flow of information among the individuals and organizations which are the key players in the R&D and entrepreneurial processes.

Figure 2 offers an overview of such a Center. But, linking Syracuse University, area libraries, and local business and industry will not be easy. Each presents its own organizational structure and climate. A number of administrative styles and features prevail. The work groups from each sector which need to be brought into contact with each other may have different

FIGURE 2

OVERVIEW: SU CENTER FOR STI TRANSFER



objectives, priorities, or values. Each group has already developed its own formal and informal information channels and patterns--some of which are ineffective and will require ongoing education to improve.

An important factor in the eventual success of the SU Center for STI Transfer will be the degree to which its organizational structure and administration are designed to be congruent with its objectives and facilitate its operations. Its placement within the framework of the existing structures, styles, and goals presented by the three sectors it seeks to link must be carefully chosen to recognize their essential differences, minimize conflict, and circumvent or reduce existing barriers.

Requirements, Mission, and Possible Services

Each of the various STI transfer approaches described in the literature seek to resolve the demands and constraints of its particular situation. Similarly, the SU Center for STI Transfer must be designed to meet the needs of its community, exploit local opportunities, and operate effectively within the confines of existing structures, values, and attitudes. Basic requirements for establishing a successful Center include:

- o location in a stable organizational setting with high visibility, credibility, and strong potential for local/national prestige
- o a governance structure that facilitates input from a number of stakeholders but also protects the Center from being dominated by individual stakeholders
- o a guaranteed commitment for sufficient start-up and basic operating expenses
- o a range of competent staff knowledgeable about the STI and technology transfer process, business information resources, design of

information retrieval and delivery systems, the unique needs and constraints of Central New York businesses and libraries, and personal contacts with area businesses and libraries.

Syracuse University could meet most or all of these requirements as a host for such a Center.

The mission for a proposed SU Center for STI Transfer might include the following objectives:

- o provide a centralized gateway to and increase access to, and management of, STI resources for SU and area businesses
- o educate and train private sector firms in the management of information resources to enhance general business health and more specifically technology development
- o increase the identification of and access to SU faculty expertise, and R&D activities
- o coordinate regional development of available technology and STI for economic benefits
- o offer a gateway to information resources and services through SU Libraries, other regional libraries and systems, and the larger information infrastructure
- o offer a gateway to individual faculty, Organized Research Units, CASE Center, and incubator settings
- o offer a gateway to STI resources management expertise at the SU School of Information Studies
- o coordinate information services for the proposed Syracuse Industrial Innovation Extension Service (IEES).

Additional roles also may be appropriate for the mission of the Center depending on the resolution of key issues identified elsewhere in this chapter.

An overview of possible services that might be provided through such a Center are suggested in Figure 3. These can be briefly described as follows:

Services

Information and Referral. Similiar to traditional I&R services in a public library context, the Center would act as an intermediary among SU research activities, Central New York business information needs, and libraries. Aattention would be given to provision of U.S. government information including legislation, regulations, and technical report literature. Provide access and referral to federal R&D activities; provide referral to appropriate federal agency programs related to STI and technolcoy transfer such as those in the National Technical Information Service (NTIS), National Aeronautics and Space Administration (NASA), Department of Energy (DOE), National Library of Medicine (NLM), and the Department of Defense (DOD)--to name but a few.

Information Delivery. Through the use of regional libraries, assist local businesses to not only identify the information they might need, but also provide abstracts, copies, or original documents as appropriate. Information resources could be delivered onsite to the requesting company within a specified time period.

Selective Scanning of Information. Center staff could develop profiles for ongoing information needs of Central New York businesses and provide them with a regular summary assessment of information on specific topics recently made available. This assessment would be more than a list of citations--rather an overview analysis of information on a particular topic suggesting possible implications and applications for a specific firm.

SU CENTER FOR STI TRANSFER: POSSIBLE ACTIVITIES

SERVICES

- o Information and Referral Among Key Stakeholders
- o Delivery of STI to Researchers and Business Community
- o Regular Scanning of STI to Meet Unique STI Needs of Clients
- o Customized Information Brokering Activities
- o Physical Access to Central NY STI Library Materials

DATABASES

- o SU Research Resource Directory Accessed by Subjects, Projects, and Faculty Expertise
- o Access to Online STI Bibliographic Databases
- o Access to Online Catalogs of Library Holdings
- o Central NY Business Information Resources

DISSEMINATION AND INTERACTION

- o Assessment of SU STI for Possible Business Development
- o Seminars Among Key Stakeholders for Technology Transfer
- o STI Ombudsperson
- o Newsletter, Reports, Electronic Bulletin Board, etc.
- o Dissemination of Individual Clients' Special R&D Activities to Selected Target Audiences (e.g. Dissemination of RADC STI to SU)

Customized Information Brokering Activities. A broad range of activities could be included within this category including on-site training programs in the use of various information handling technologies, strategies for Information Resources Management in a specific firm, or development of customized reports/analyses on topics of special interest to a specific firm.

Databases

SU Research Resource File. Minimally, this would be a database of key SU research products, funding opportunities, and faculty researchers with a listing and description of research activities and initiatives that may be of interest or have potential application to the Central New York business community. (This database is described in more detail in the Recommendations section of this chapter.)

Online Bibliographic Databases. These are the traditional databases provided through DIALOG, BRS, WILSONLINE, etc. that could be searched in response to specific requests from members of the business community. These databases provide access to a myriad of resources including government technical report literature, business/economic information, scholarly reports, market analyses, national newspapers, and a wide spectrum of other information. Appendix D lists the databases available through the DIALOG system.

Online Catalogs of Library Holdings. Syracuse University library holdings can be searched on line through the SULIRS system. Syracuse University, as an associate member of the Research Libraries Group has access to RLIN, a database emphasizing research and scholarly publications. Access to the

online catalog of the New York State Library (NYSILL) and referral libraries in the SUNY system, Cornell, etc., is available through CENTRO, OCPL, and Mid York Library System. In addition, a number of libraries in the area can access OCLC which provides online searching to some 15 million titles available on loan throughout the United States and Canada.

Central New York Library Business Information Resource File. This would be a database of unique or otherwise significant business and STI services and resources available from academic, public, special libraries and other identified agencies in the Central New York area. The database would also include liaison or contact individuals associated with each of these collections/services.

Dissemination and Interaction

Technology Assessment. Scanning of research activities at SU and identification of those projects and or activities that have potential for product/process commercialization. Specific techniques by which R&D can be evaluated in terms of new product development ventures are well-known and can be applied in assessing SU Research activities (National Technical Information Service, 1986). At a broader level, the Center staff can inform area businesses of new technologies that may have application in their particular setting. Some of these are regularly described in, for example, NTIS Tech Notes, Federal Technology Catalogs, and the online database Federal Applied Technology.

Seminars. A broad range of activities could occur here. SU researchers could present status reports on various research activities that may have potential

for product development and commercialization. Center staff might conduct brainstorming think-tank discussions on particular problems or issues that cut across technology transfer topics. Local librarians/information specialists can present discussions regarding specific technology-driven topics or use of new information processing technologies with application for information resources management.

STI Ombudsperson. A number of different models could be used to develop this dissemination technique. We might borrow on the Agriculture Extension model to go into the business community to demonstrate new information technologies and solve information management problems. Another approach is the "Circuit Rider" concept where an individual travels a "circuit" of local businesses identifying and resolving their specific business information needs.

Electronic Mail/Bulletin Board. Center clientele could communicate directly with the Center or, perhaps, with each other via electronic mail. A bulletin board could be organized to announce products, services, and various activities of the Center. The system, perhaps, could be connected to larger state and national data transmission systems such as BIBNET, NYSERNET, the New York Department of Education's Technology Network Ties (TNT), etc.

Newsletters. These could be targeted at a different clientele and provide regular announcement of Center services, updates on research activities in the area and at SU, suggestions and in-depth analyses of specific areas of interests to Center clientele, and perhaps discussions of new or emerging technologies.

Focus Papers. Published reports and occasional papers that provide an in-depth analysis of potential areas for technology application and appropriate STI that might be used in the development of this application. Such papers from both SU faculty and area business community researchers could serve as a focus point for seminars and brainstorming sessions on how best to exploit local technologies and STI for economic development.

These possible services are not intended to be comprehensive or exhaustively described. Rather, they provide a flavor of the kind of activities that might occur in the Center. Furthermore, the range of services to be offered will depend on the agreed upon mission for the Center and the availability of funds.

Current SU Organizational and Administrative Structure

SU's organizational structure for administering campus research activities and university/industry interactions parallels that found in other major research universities. The Vice Chancellor for Academic Affairs, as head of the Office of Academic Affairs, reports to the Chancellor and President of SU. Reporting to the Vice Chancellor are three constituencies which should be closely related to the Center: the academic Deans (including the Dean of the School of Information Studies), the University Librarian, and the Vice President for Research and Graduate Studies.

Reporting to the Vice President for Research and Graduate Studies are the Director of the CASE Center and the Executive Director of the Division of Research Support and Administration. The Division of Research Support and Administration is a newly restructured unit which includes the Office of Sponsored Programs--responsible for proposal development, processing, and

submittal and grant award negotiations and administration--and the Office of Research Development and Special Projects. The responsibilities of this latter office include major project development, technology transfer, and research information services; its functions appear quite closely related to those of a Center for STI Transfer. Its director has as one of his responsibilities the building of an "SU Database" of faculty research interests, research projects, and related contents.

Involvement of the SU School of Information Studies

A key player in the design and implementation of a Center for STI transfer is the SU School of Information Studies. This School's involvement in the Center is crucial because:

- o it conducted the feasibility study for such a Center and is already familiar with the key players and issues
- o students and faculty are skilled in the evaluation of user information needs and developing information retrieval systems to meet those needs
- o they may be able to provide some start-up space for the Center in the new Science & Technology Building
- o faculty and students have the a community service orientation
- o the School may contribute to the staffing of the Center by providing highly competent students at relatively inexpensive costs
- o the Dean and several individual faculty members are well-known and respected in the business, library, and government arenas
- o the School's faculty and staff have the knowledge, training, and skills to design and implement the proposed STI Transfer Center services (e.g., database design, construction, and maintenance; bibliographic control; I&R activities).

However, no formal discussion has taken place among the faculty of the School as to the appropriateness of the School's direct involvement in the design and operation of such a Center at this time.

Criteria to Compare Administrative Structures

Criteria for evaluating alternative organizational and administrative structures for a Center for STI Transfer are based on "success factors" identified in the literature, suggestions from interviewees, and the unique requirements apparent in Central New York. These criteria include:

- o **Leadership:** The Center must fall under the leadership of an enthusiastic individual with strong management capabilities who is respected in the business, library, and academic communities.
- o **Participant Support:** The Center must have full support from employees, network participants, and of SU faculty, researchers, and administration.
- o **Flexibility:** The Center must have "long-term" flexibility; i.e., it must be administered in such a way that it is allowed to alter its basic policies, programs, and services to meet changing demands.
- o **Responsiveness:** The Center must have the autonomy and authority to make quick decisions and take action, in order to adequately serve its clients' immediate needs.
- o **Stable Funding:** The Center must maintain stable funding sources and establish fee structures that ensure its continued solvency and do not demand excessive staff time being dedicated to "staying afloat" rather than providing services.
- o **Visibility:** The Center must occupy a highly visible space and be allowed to market its services aggressively, in order to raise general awareness of the importance of STI.

- o **Centralization/Decentralization:** The Center must combine the benefits of a widely dispersed outreach, referral, and delivery network with the advantages of centralized communications and control to operate most efficiently and effectively.
- o **Perceived Importance/Influence/Credibility:** The Center must occupy a position high enough in the SU organizational hierarchy to gain the support and confidence of clients and key players, maintain its funding, and retain the open communication channels which are critical to its success.
- o **Breadth of Services Possible:** The Center must have the ability and authority to provide the wide range of services which are required and to modify those services in response to a changing user needs.
- o **Congruence with SU Mission:** The Center must be governed in such a way that its policies and services reflect the mission of the institution housing it, while at the same time they are not discordant with the objectives of its clients.
- o **Service Orientation:** The Center must be governed and operated in such a way that the mutual goal of economic development and the resolution of individual client needs in support of this goal are not undermined by the separate agendas of any one of the key individuals or organizations involved.

Alternative Administrative Models

Fee Based Library Unit. The Center for STI Transfer could be a fairly autonomous fee-based unit operating within the SU Libraries. The Director of the Center would report to the University Librarian. Policy decisions would be made by the Director and approved by the University Librarian. Activities

could be based, primarily, on traditional library services. However, these services would be fee-based and users would be expected to purchase them as they would any other commodity.

School of Information Studies Unit. The STI Transfer Center could operate out of the Science and Technology Center and be administered by the School of Information Studies faculty and students. Faculty or staff could serve as Director (part-time) and the management of daily operations would be turned over to graduate students. The Dean of the School of Information Studies would have authority over the Center. An informal Advisory Council might be comprised of positions such as: the Director of the Office of Research Development and Special Projects, the University Librarian, the Director of CENTRO, the Directors of the OCPL and Mid York Library Systems, the Director of the CASE Center, and the Vice President for Economic Development of the Greater Syracuse Area Chamber of Commerce.

Service offerings could range from Information and Referral (I&R) to basic library-type services, and also include some database design and implementation. Information services relying on the resources of the SU Libraries and area academic, public, and special libraries would be provided by School of Information Study students, hopefully keeping the imposition on library staff to a minimum. Participating libraries might acquire SU tuition credits for their staff as a partial reimbursement for their contribution of effort.

Regional STI Switching Center. The Center for STI Transfer, located in the new Science and Technology Center, could operate as a "switching station" between campus R&D activities, area STI resources, and local business and industry. The Director of the Center could report to the Vice President for

Research and Graduate Studies. Policy decisions would be reviewed and approved by a Policy Board which might consist of the Dean of Information Studies, the Executive Director for Research Support and Administration, the Vice President for Economic Development of the Greater Syracuse Area Chamber of Commerce, and the CEO of a major local corporation.

An Advisory Council could make suggestions for implementing, maintaining, or altering programs and policies. The Advisory Council would include the University Librarian, the Director of the CASE Center, the Director of the Technology and Information Policy Program (TIPP), the Management, Engineering, and CIS Deans, the Executive Director of the Greater Syracuse Business Incubator Center, the Directors of CENTRO, OCPL, and Mid-York Library Systems, and several Information Services Managers from local firms.

Non-Profit Government/Private Sector Agency. The Center for STI Transfer, located in the downtown Syracuse area, would have a Liaison Officer or representative on campus and would operate as a non-profit, government-sponsored organization, subject to the policies set forth by a governing body. Its programs would also be partially determined by governmental or business community demands. Funding would likely be more directly linked to either a local government agency or an individual corporate firm. It would be geared to economic development through extension services (STI transfer and technology transfer) to small businesses.

Comparing Alternative Models

These four design alternatives are offered as a basis for discussion and further analysis. They can be evaluated by criteria established earlier in this section and a brief assessment of each follows.

Design Alternative I: Fee-based Library Unit

A strength of this approach is that the Center would be closely related to the SU library and thus, be able to quickly access the range of library resources available. On the other hand, the image of the Center as "part" of the library may not be the one to best present to the business and R&D community. Further, the operation of the Center may become "buried" in the library structure and clearly, the SU library currently has a full agenda of projects and issues.

Another potential problem is the need for the Center staff to be closely aligned to the R&D process on campus, to be knowledgeable of the technology transfer process, and to have close contacts with researchers on campus and in the business community. However, the service orientation provided by a library perspective and knowledge of meeting user information needs may overcome some of these difficulties. In addition, the SU library has immediate access to a broad range of external STI and business information resources.

Design Alternative II: School of Information Studies Operation

A key issue with this design is the appropriateness of an academic unit administering a service activity. There may be some "uncomfortableness" in the School with this dual personality. However, this approach encourages direct involvement of faculty and students who would be instrumental in the design and implementation of a Center. Another plus for this approach is the emphasis that could be placed in the Center on the design of various educational programs in information management--both on campus and in the business community.

However, the School may not project the type of image necessary for the success of the Center. The business community will want to deal with practical "down-to-earth" staffers and may find too much "academese." While the School might be strong in the design and implementation of a broad range of information services, it may lack the experience and knowledge in operating a service agency. For both this design and the Fee Based Model, appropriate reward structures for faculty would have to be identified if faculty and staff were to commit time and resources to the Center.

Design Alternative III: "Switching Station"

In this approach, a degree of independence from specific academic departments could be realized. An administrative structure that reports directly to the Vice President for Research and Graduate Studies could assist the Center in obtaining high visibility both on and off campus. A broad policy board and advisory group might also increase the range of involvement and ideas for Center staff.

A physical location in the Science and Technology Center would increase its visibility and allow it to work closely with the CASE Center and other research activities at the Center. Remote delivery sites and offices throughout the region (perhaps through Utica College of Syracuse University) and other regional libraries would enhance the image of the Center as a switching station providing "on-site" and personalized information services.

However, the Center might also be left outside mainstream university activities without the guidance of an energetic and strong leader. But if the Center was marketed and positioned much as the CASE center, it could obtain high visibility and credibility in the local business community. Further, this approach would allow the Center to draw upon a broad range of university

resources from many academic and administrative areas, as needed, rather than being linked only to one specific area.

Design Alternative IV: Non-Profit Government-Sponsored Entity

This design would not be hosted at SU but perhaps in a regional area office or corporate setting. This model is the most difficult to evaluate because many of its features are contingent upon more unpredictable variables than are those of the other models: much will hinge on the power, reputation, effectiveness, and structure of the particular governing agent which oversees the STI Transfer Center's operations.

One problem with this approach is that the Center may suffer from a lack of prestige by not being associated directly with the University. Further, the Center may have to spend more time than is desirable in dealing with various local political issues rather than concentrating on STI transfer and services. It may also lack immediate access to the technical expertise needed (and available at SU) for designing information systems and providing information services.

Assessment

Design Alternative III, the "switching station" model, seems to provide the most feasible option for the proposed SU Center for STI Transfer. This model best fulfills the evaluation criteria which were identified from the literature and applied to the local needs, opportunities, and constraints of the Central New York region in general, and the three key constituencies in particular.

Its most beneficial features include: the program and policy flexibility, achieved through separating these two functions via the Policy Board and Advisory Council, which are needed to support the rapidly changing STI needs of a dynamic business and economic environment; the position of influence the Center gains from occupying a relatively high place in the SU organizational hierarchy and being associated with a prestigious branch of SU administration; a stable budget; and the ability to build on existing and natural communication links to encourage the information flows which facilitate the technology transfer process.

The "switching station" model also appears well-suited to circumvent the political entanglements inherent in any joint venture which seeks to link such disparate communities: basically, it would offer, independently, many services "cast off" by other key players on campus and in the region. By exploiting existing expertise, knowledge, and resources through sharing and cooperation, it may also prove the most cost-effective option in the long run.

Financial Considerations

Regardless of the specific administrative structure that might be selected for a Center, some very rough budgetary figures can be offered based on the proposed mission and services suggested earlier in this section. Assuming that Syracuse University provides space and utilities for a Center, there would be two initial cost categories to consider.

The first would be one time, start-up costs related to equipment, supplies, computer support, and communications in the range of \$75,000 to \$125,000. Recurring costs for salaries and expendable materials may range between \$125,000 to \$200,000 annually. These figures are offered as ranges, based on a distillation of the literature, proposed services and programs, and

the view that such a Center would be designed as a first-rate operation and not be "piggy-backed" on other existing operating budgets.

The income to operate the Center is likely to come from a number of different sources. We would anticipate that a start-up grant to cover the first year of implementation could be obtained from local, state, or private sources. After start-up, operational expenses might be obtained from a combination of in-kind contributions from Syracuse University, regular support from regional government agencies, fees from clientele for the provision of services, and perhaps additional grants and contributions from local businesses.

No attempt is made in this report to offer detailed cost analyses for the establishment of such a Center. Such analysis is necessary and should be done in a design phase for the Center. Furthermore, changes in the mission of the Center, e.g., if it assumes responsibility for both technology and STI transfer, could radically change cost estimates. The point of this section, however, is to suggest that a first-rate operation to enhance access to and use of STI (and perhaps technology) for regional economic development cannot be done by a "nickel and dime" budget.

An Operational Example

Imagine that the SU Center for STI transfer has a base office in the soon-to-be-built Science and Technology Center. The Center serves as a (1) gateway for centralized access to University STI and the larger STI/business information environment, (2) switching center to match the STI and business information needs of the academic community and the business community with the local and external information infrastructure, and (3) manager/provider of STI and business information services for regional economic development.

Individuals might approach the Center directly by either in-person or telephone requests. Center staff would assess the information request and either provide an immediate response to resolve the request or propose an estimate of the cost and effort that might be necessary to resolve the information need. Thus, there might be a level of responses which would be provided free (e.g., is there a faculty person knowledgeable about genetic engineering available to do consulting?), and a second level within which there might be various fees attached to specific services (e.g., can you provide me with an analysis of the most significant technologies likely to affect sewage treatment plants in the next five years?).

In terms of education and training, the Center might regularly offer on-site and off-site educational programs, briefings on current "hot" research topics, or "think tank" sessions among SU faculty, invited experts, and local businessmen. It might provide a "business circuit rider" to work directly with individual businesses in the region assessing their STI and business information needs and offering customized solutions. Such an approach can be based on the agriculture "extension model" which can be applied for managing and utilizing STI and business information.

While the Center might respond to requests directly, it could also be a proactive educator stressing the importance and use of STI and business information for economic development, technology transfer, and the development of innovations. The Center could establish "branch" activities in a number of locations throughout the region. Indeed, the range of services and activities which the Center might provide is limited only by one's imagination and fiscal constraints.

Benefits of A SU Center for STI Transfer

Economic vitality and development is critical for the overall health of a region. But regions must now compete against other regions to obtain new businesses and maintain those already present. The literature review suggested that those firms that are most successful, profitable, and innovative are those that:

- o acquire and manage a wide range of information resources effectively, and
- o incorporate such information into their marketing and R&D decision making activities.

Syracuse University, the local business community, and local/state government agencies can assist this economic development by fostering an information infrastructure that encourages technology transfer and the use of information resources for economic development.

A broad range of benefits would result from the establishment of such a Center, including:

- o increased ability to attract new firms into the area because they would have access to services of the Center--which other regional competitors cannot offer
- o increased ability to assist existing firms be more competitive and more profitable
- o better communication and use of existing information resources among SU researchers, librarians, and businesspeople
- o improved coordination of SU research activities and marketing of those research skills
- o increased visibility for both SU and the region as a dynamic and supportive environment for innovation and technology development

- o increased likelihood for obtaining research funds to support joint new SU research program initiatives and research projects among the key stakeholders
- o better leverage to maximize the impact of R&D from major research units at SU including the CASE Center and SUPAC
- o support for a "laboratory environment" where SU students can be directly involved in STI/technology transfer programs/services and can conduct research related to the effectiveness of such services.

Other broader benefits may result, as well, such as an increased tax base for the Central New York region. However, for the Center to be realized and these benefits to result, the following recommendations should be considered.

SUMMARY RECOMMENDATIONS

Realization of a Center for STI Transfer at Syracuse University will require additional study and strategic planning to address a number of key issues identified throughout this chapter. The following recommendations are offered as initial steps to reach that realization.

Establish Coordinated Leadership and Planning

Coordinated leadership and planning efforts must be orchestrated within SU, among government/private sector firms, and between these two groups. Additionally, such planning needs to occur at top management/administrative levels. Currently, there is a plethora of ideas and suggestions from mid-levels within interested stakeholder organizations but virtually no comprehensive strategic planning. Political considerations among these key stakeholders have to be resolved by top management/administration and cannot

be resolved by individual SU faculty, area librarians, or mid-level government and corporate officials.

Key questions that should be addressed in such planning activities include the following:

- o how can the information management skills of the SU research community and the regional business community be enhanced so that such a Center can be effectively utilized?
- o what is the mission for such a center, i.e., should the Center stress technology transfer, STI transfer, business information transfer, or all three?
- o what regional stakeholders have an interest in supporting such a Center and to what degree are they willing to pay for Center services such as those proposed earlier in this chapter?
- o what administrative structures and governance bodies are most appropriate given the types of stakeholders to be involved in the Center?
- o to what degree is technology and STI transfer to the Central New York region for economic development a priority for Syracuse University?

These items are intended to be suggestive rather than exhaustive. But generally, their resolution will require dialogue among many of the stakeholders. Further, detailed proposals by one particular constituency are not likely to be successful for comprehensive regional economic development.

In such planning efforts, we would recommend a phased approach for project development--the next phase of this project being a planning and design phase. The purpose of this phase is to produce an operational design for a Center for STI/technology transfer at Syracuse University and to identify and obtain start-up funds to implement such a Center. In this design phase, a design team of top level administrators/managers would work on the

project from each of the various key constituencies. At the completion of the design phase--expected to require 5-8 months--the last phase of the project, the implementation phase, of perhaps 12-18 months could begin.

Recognize the Costs for Providing Information Services

As a nation, we have done a very poor job of managing and exploiting the STI that results from funded research projects. The National Science Foundation estimates that some \$100 billion is spent annually for U.S. R&D efforts--some 46% of that is spent by the Federal government (National Science Board, 1985). But the amount of resources spent on managing this resultant STI, either by the government or by individual universities and private firms is virtually non-existent by comparison. Indeed, recent research suggests that the success of technology transfer, innovation, and commercialization of new products is as much the result of managing and exploiting available STI as it is the result of producing it in the first place (McClure, 1987).

Establishing a successful information infrastructure to support STI and technology transfer for regional economic development requires resources. If one objective is to exploit SU research, its resulting STI, and the broad range of available business information for local economic development, the costs must be borne by someone or something. Requiring a \$65,000 per year scientist to spend one day obtaining information about a particular recent development that an information specialist could resolve in one hour is simply bad management. Yet, this and similar illustrations were reported to us by a number of interviewees.

The lifeblood for technology transfer and innovation is STI. The lifeblood for successful strategic corporate decision making is business information. Given the complexity of today's information infrastructure those

businesses that can harness the power of information resources are likely to survive and prosper; those that do not, may find themselves loosing markets and finding their firms to be less profitable. Those businesses which recognize the value of obtaining information and incorporating it into the corporate decision making process also recognize that, similar to other resources, there is an associated cost.

Expand the Key Constituencies

The key constituencies considered in this study were Syracuse University, Central New York businesses, and selected academic, special, and public libraries. However, one of the most significant players in the area of R&D, technology development, and production of STI is the Rome Air Development Center (RADC). If Central New York is to develop a Center for STI/technology transfer, it is critical that RADC be involved. It is one of the most important R&D facilities in the Central New York region.

As a Federal lab, RADC has requirements under the Stevenson-Wylder Act and the recent Executive Order, "Facilitating Access to Science and Technology" (1987) to transfer technology out of the lab and into the private sector and universities. RADC should be actively involved in the planning for and as a participant in a SU Center for STI/technology transfer.

Another constituency that should be considered as a potentially key stakeholder in the success of the Center is the State University of New York (SUNY) College of Environmental Sciences and Forestry (ESF). This college is heavily engaged in many research activities--the majority of which have high potential impact for technology transfer and new product development.

Similarly, the broad range of health science research at the SUNY Health Science Center at Syracuse and associated medical research facilities in the Syracuse area should also be considered as key players in the Central New York R&D community. Their involvement in a Center for STI transfer should also be considered. Other educational facilities in the region may be able to provide important contributions. For example, the SUNY College of Technology in Utica may play an important role. Additional investigation into possible roles for these institutions appears to be appropriate.

Also noticably absent, is a discussion about the role and possible involvement of local governments in the proposed Center. City and county governments in the Central New York region should also be approached as to their possible involvement in the Center, the degree to which they might be able to formally support the enterprise, and to identify areas where the Center might assist them in promoting regional economic development.

Examine Successful STI/Technology Transfer Centers

Although this project identified a number of STI/technology transfer "operations" from the literature (see Chapter 2), it is difficult to assess their overall success or effectiveness. In planning for a Center, we recommend that a study team visit some of these operations to learn which factors contributed to their success. Potential sites include operations identified in Chapter 2, New York Industrial Innovation Extension Services (IIES) locations, academic institutions, and Federal labs.

Design Reward Structures for Faculty Participation

During the interviews with SU officials and faculty the issue of rewarding faculty for involvement in STI/technology processes was mentioned frequently. Traditional reward structures for faculty are based on teaching and scholarly publication and research. In some instances both faculty and university officials may decide that faculty involvement in regional economic development, STI/technology transfer, and business community development is inappropriate as a faculty activity.

Such determinations may be encouraged, subtly, because there typically are limited means by which the University rewards faculty for assuming such responsibilities. One faculty interviewee commented that the last thing he wanted was to have his name made available to the business community for consulting and economic development, "I'd never get any research done if I had to spend all my time talking to everyone!"

Thus, if the Center is to draw upon the expertise of faculty, reward structures have to be in place to encourage such involvement. For some, consulting opportunities may be appropriate, for others, involvement might be considered as a factor contributing toward tenure and promotion. But generally, it is unlikely that many faculty would actively participate in the Center at the expense of their traditional activities in teaching and research without clear and encouraging reward structures.

Recognize the Need for Innovative and Flexible Information Services

There is no easy formula to predict specific information needs of individual business or faculty engaged in the production and use of STI specifically for technology transfer, innovation, and product development.

Thus, the services suggested in Figure 3 are likely to need customized and individual refinement to meet contingencies and constraints in a specific information use environment.

For example, we found that in the small businesses in the region successful access to and use of a broad range of business information (not STI) could have significant impact in terms of identifying new markets, refining manufacturing processes, or managing personnel. However, in some of the R&D labs at large firms, entirely different information needs were identified. In such instances, specific STI on a very narrow topic may be required to resolve an information need. In other cases, such as the incubator firms developing a new technology for commercialization, the information needs are likely to be different yet.

In short, we recommend that the types of services suggested in Figure 3 be seen as generic types--they will need to be tailored for the needs of specific clientele if the services are to be successful. A Center for STI Transfer must be flexible in the provision of such services and be able to provide one-on-one, customized responses to a broad range of information needs. Delivery of the information to the point of decision making is essential if it is to be used. Typically, provision of a citation to a journal article or the publication of a newsletter with "good ideas" will be of little assistance to businesspeople racked against the day-to-day pressures to make decisions in a timely fashion, or to an engineer trying to solve a technical problem.

Establish an SU Research Resources Database

Regardless of any decision to design a Center for STI/technology transfer, Syracuse University should work to produce a comprehensive database

of research resources. Such a database, minimally, should include the following components:

- o comprehensive listing of SU funded research projects: this component should also include abstracts, with information retrievable by, for example, key words, controlled subject terms, faculty name, department, funding agency, award amount, year awarded, and so forth
- o faculty profile: describes faculty research interests, special expertise, and availability for consulting in the private sector
- o research funding opportunities: a comprehensive list of funding opportunities from federal agencies, foundations, corporations, etc. which might be used to foster joint research project between SU faculty and regional businesses
- o faculty research products: a comprehensive listing of faculty research products including scholarly reports, in-house studies, technical reports, monographs, etc.

No attempt is made here to offer design criteria for such a database since other sources are available on this topic (see, for example, Harmon and McClure, 1985). Rather, the intent is to stress the importance for a comprehensive database related to SU research resources.

Output from such a system can be programmed to meet specific needs: a listing of all faculty available to provide consulting in the general area of artificial intelligence, current scanning of research opportunities for a particular faculty member with particular research interests, list of all faculty publications on a given topical area, and so forth. Development of such a database is critical if the business community is to have a central place to identify specific faculty expertise and possibly, contact them.

INCREASING THE EFFECTIVENESS OF STI/TECHNOLOGY TRANSFER

This study concludes that it is indeed feasible to design and establish a Center for STI/Technology Transfer at Syracuse University. There is widespread support for such an effort from a broad range of key stakeholders. And clearly, the resources necessary for designing such a Center are available in the region. A number of positive signs can be identified to support this optimistic view.

First, simply that this feasibility study was funded and supported by Syracuse University, the Greater Syracuse Chamber of Commerce, Niagara Mohawk Power Corporation, Gaylord Brothers, Inc., and the Central New York Library Resources Council is an important starting point. Second, the completion of the study, in itself has created much greater awareness among key stakeholders as to the importance of such a Center. Third, as this report is being written, the Syracuse University Vice President for Research and Graduate Studies has created a university-wide task force to consider possible approaches for facilitating STI/technology transfer at SU.

The Central New York region cannot afford to ignore the results, conclusions, and recommendations resulting from this feasibility study. If we, as a region, are to enhance the infrastructure for economic development and attract/create new businesses to the area, we must better position and market our strengths. Those strengths include a developing research institution with growing research prowess, progressive leadership from local businesses and government officials, and a dynamic and committed core of librarians and information professionals knowledgeable about management of information resources.

The issue to be addressed is the degree of commitment that these various stakeholders are willing to make to exploit our region's strengths, to establish an STI and business information infrastructure to promote technology transfer and regional economic development, and take a leadership stance. The establishment of important research activities at SU such as the CASE Center and SUPAC must be exploited through an information infrastructure to exploit STI/technology transfer if economic development is to occur. A coordinated effort to establish a SU Center for STI/technology Transfer is not only feasible, it is essential for the economic growth and vitality of the Central New York region.

APPENDICES

**SCIENCE AND TECHNOLOGY INFORMATION TRANSFER PROJECT
BUSINESS QUESTIONNAIRE**

APPENDIX A

SCIENCE AND TECHNOLOGY INFORMATION (STI) INCLUDES ANY BUSINESS OR RESEARCH INFORMATION USEFUL FOR ORGANIZATIONAL DECISION-MAKING OR RESEARCH AND DEVELOPMENT (R&D)

Instructions: please complete the following questionnaire as carefully as possible. Your opinions and ideas are important to the outcome of this project. If you have any questions or comments, call **Roberto Rangel** at (215) 423-2911. Thank you for your help.

1. Organization name: _____
2. Does your organization belong to any library system or information-sharing consortium? Please list: _____
3. Does your organization conduct internal R&D?
 - () No, we rarely conduct internal R&D.
 - () Yes, a typical example of the type of R&D we conduct is:
4. Please check the STI services currently available to your organization:
 - () In-house collection of books, magazines, journals
 - () In-house Librarian or Information Manager
 - () In-house access to online databases
 - () Outside consultants providing specific information services
 - () Other (describe) _____
5. What barriers limit your access to the STI most needed to run your organization effectively? (check all that apply)
 - () None
 - () Do not know how to acquire it
 - () It is too expensive to obtain
 - () It is too troublesome to identify
 - () Cannot determine if needed information is available
 - () Other (describe) _____
6. Have you or any member of your organization contacted any outside library (academic, public, or corporate) or library system during the last six months for purposes of resolving your organization's STI needs?
 - () No, we rarely use any type of outside library or library system to resolve the organization's information needs.
 - () If yes, please identify those outside libraries or library systems contacted, note the type of service used, and use the scale below to assess the usefulness of the transaction:

1=Very useful 2=Somewhat useful 3=Not useful 4=Do not know/not applicable.

Library	Type of service used	Usefulness
_____	_____	__
_____	_____	__
_____	_____	__
_____	_____	__
_____	_____	__

7. Have you or any member of your organization contacted Syracuse University Faculty/Staff during the last six months to obtain information useful for organizational decision-making?
 - () No, we rarely contact SU faculty/staff
 - () If yes, please complete the chart below

1=Very useful 2=Somewhat useful 3=Not useful 4=Do not know/not applicable

Office/Faculty/staff	Type of information requested	Usefulness
_____	_____	__
_____	_____	__
_____	_____	__

How did you know whom to contact? _____

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APPENDIX A
(CONTINUED)

8. From the following list of potential STI services, please check those that your organization would find most useful:

- ☐ A database or directory of key SU research programs and faculty researchers with a description of their activities.
- ☐ Scanning of research activities at SU and identification of those projects that have potential for commercialization.
- ☐ An individual profile of your organization's ongoing research and STI needs, and a regular summary listing of recent SU research activities on those topics.
- ☐ Electronic Mail or Bulletin Board providing direct communication with a central office at SU which would assist you in acquiring research and STI.
- ☐ Customized reports on topics of special interest to your organization.
- ☐ On-site training in information resource management and technologies.
- ☐ A database or directory of unique or otherwise significant business information services and resources available from selected libraries in the Central New York area.
- ☐ Access to research and STI from online databases such as BUSINESSWIRE, INVESTEXT, CHEMSEARCH, FEDERAL RESEARCH IN PROGRESS, SCISEARCH, COMPENDEX, among many others.
- ☐ Access to U.S. government information including legislation, regulations, and technical report literature; and referral to appropriate federal agency programs related to STI and technology transfer such as those at the National Technical Information Service, the National Aeronautic and Space Administration, the Dept. of Energy, the National Library of Medicine, the Environmental Protection Agency, or the Dept. of Defense.
- ☐ Access to STI resources available throughout the Central New York region (Onondaga, Oneida, Madison and Herkimer counties)

9. On an annual basis, please estimate the amount of money (including money spent on staff time, materials, equipment, books and magazines, etc.) your organization spends on acquiring STI:

- ☐ \$500 or less
- ☐ Between \$500 - \$10,000
- ☐ \$10,000 or more

10. Please use the remainder of this page to offer suggestions regarding:
1) your use of information for corporate research and development; and
2) potential roles that SU and/or area libraries might play in assisting you utilize new technologies, research, and STI.

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SCIENCE AND TECHNOLOGY INFORMATION (STI) TRANSFER PROJECT
LIBRARY QUESTIONNAIRE

Instructions: Please complete the following questionnaire as carefully as possible. Your opinions and ideas are important to the outcome of this project. If you have any questions or comments, call Ann Bishop at (313) 423-2911. Thank you for your help.

Your name: _____

Name of library: _____

No. of professional staff: _____

Library belongs to the following information-sharing networks, consortia, systems (please list): _____

1. Please use the following scale to indicate the relative emphasis your library places on serving the needs of the clientele described below:

1=high priority 2=moderate priority 3=low priority 4=don't know/not applic.

PRIORITY	TYPE OF CLIENTELE
_____	local business community
_____	local researchers (chemists, engineers, etc.)

2. What types of organizations do these patrons come from? Please rank each of the following from 1-4 according to frequency of contact (1=most frequent contact):

_____ small businesses	_____ educational institutions
_____ large corporations	_____ government agencies
_____ non-profit groups (excl. govt. agencies)	
_____ other: _____	

3. How do they contact you? Please supply the average number of contacts/month:

#/MONTH	TYPE OF CONTACT
_____	in person
_____	telephone
_____	by mail

4. Please use the following scale to assess your library's strength in those areas described below:

1=very strong 2=strong 3=not very strong 4=fairly weak 5=very weak

STRENGTH	TYPE OF COLLECTION
_____	business information resources and services
_____	science and technology information (STI) resources and services

5. Please check the types of information most frequently sought at your library by members of the business or research community:

() statistics	() market analysis
() patents	() competitor profiles
() business law	() advertising and promotion
() accounting/bookkeeping	() general management
() computer use	
() technical data to refine products/production	
() government regulations/legislation/reports	
() other:	

6. How frequently does your library use the following resources in answering business or research requests? Please give examples of the best, most unique, or most frequently used sources in each category:

1= more than 20 times/week 2= 5-20 times/week 3= fewer than five times/week

FREQ. OF USE	TYPE OF RESOURCE	EXAMPLE
_____	in-house collection	_____
_____	online databases	_____
_____	interlibrary loan	_____
_____	referral to nearby libraries	_____
_____	outside information services	_____
_____	contacting experts	_____
_____	other: _____	_____

7. Does your library charge fees for any of its services to the business or research community? Yes/No (Circle one) If yes, please describe below:

SERVICE	(FEE)	WHO CHARGED?
_____	(\$ _____ per _____)	_____
_____	(\$ _____ per _____)	_____
_____	(\$ _____ per _____)	_____

APPENDIX B

(CONTINUED)

9. Please use the scale below to indicate how frequently your library provides the following services to the business and research community, how effective you feel the services are, and your degree of interest in providing those services not currently offered:

1=frequently;
very effective;
very interested

2=sometimes;
somewhat effective;
some interest

3=never;
ineffective
no interest

4=don't know/not applic.

FREQUENCY	TYPE OF SERVICE	EFFECTIVENESS	INTEREST
_____	assembling bibliographies	_____	_____
_____	basic reference	_____	_____
_____	cataloging an organization's collection	_____	_____
_____	clipping service	_____	_____
_____	computer training, loans, etc.	_____	_____
_____	document delivery	_____	_____
_____	editing	_____	_____
_____	fact verification	_____	_____
_____	indexing	_____	_____
_____	information and referral (I&R)	_____	_____
_____	information systems consulting	_____	_____
_____	interlibrary loan	_____	_____
_____	manual searching of abstracts indexes	_____	_____
_____	market reports	_____	_____
_____	online searching	_____	_____
_____	research	_____	_____
_____	selective dissemination of information (SDI)	_____	_____
_____	seminars, lectures, workshops	_____	_____
_____	(ex: _____)	_____	_____
_____	training information users	_____	_____
_____	translating	_____	_____
_____	other: _____	_____	_____

9. What barriers have you encountered in attempting to resolve the information needs of members of the business and research community? Please check any which apply and note any additional difficulties:

- ☐ They are unaware of our services
- ☐ Our location is not convenient for them
- ☐ Our hours are not convenient for them
- ☐ We do not know enough about their needs
- ☐ Business services are too expensive/time-consuming
- ☐ Science and technology research services are too expensive/time-consuming
- ☐ Lack of cooperation with other libraries
- ☐ Lack of agreement among library staff about providing such services
- ☐ Others: _____
- ☐ Other: _____
- ☐ Other: _____

10. What incentives would encourage your library to take a more active role in providing information services to the business and research community? Please check those which apply; be as realistic as possible:

- ☐ better business/STI collection
- ☐ new equipment (please specify: _____)
- ☐ more free staff time
- ☐ additional staff training (please specify: _____)
- ☐ more staff
- new funding sources:
 - ☐ portion of regular budget devoted to new business/STI programs
 - ☐ financial support from STI Transfer Project funders
 - ☐ direct fees from new business/STI programs
- ☐ good publicity
- ☐ increased access for own library to other libraries' resources
- ☐ probability of attracting new clients
- ☐ possibility of promoting local economic development

11. Please note any additional comments you may have regarding the provision of information services to members of the business and research community:

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APPENDIX C

SELECTED RECENT SU FUNDED RESEARCH PROJECTS

- T. Fondy, Biology Dept., awarded \$68,268 for "Cytochalasin Effects In Vivo on Host-Tumor Interactions," by the American Cancer Society.
- J. Fendler, Chemistry Dept., awarded \$270,000 for "Interactions and Reactions in Polymerized Vesicles," by APO.
- G. Levy, Chemistry Dept., awarded \$541,300 for "NIH Resource for Multi-nuclei NMR and Data Processing," by National Institutes of Health.
- J. Spencer, Chemistry Dept., awarded \$11,000 for "Synthesis, Structure, Reactivities, and Organometallic Chemistry..."
- E. Muller, Geology Dept., awarded \$14,851 for "Geological Resources Guidebook for the Seaway Trail," by St. Lawrence County.
- R. Oddy and L. Liddy, Information Studies, awarded \$90,000 for "Use of Document Frame-Structure Clues in Negotiating Ill-formed Information Needs," by Bell West.
- P. Dowben, Physics Dept., awarded \$39,000 for "Investigation of the Formation and Decomposition of Organometallic Compounds," by the New York State Science and Technology Foundation.
- P. Dowben, Physics Dept., awarded \$15,000 for "The Influence of Adsorbates upon the Surface Electronic Structure of Iron..."
- M. Goldberg, et. al., Physics Dept., awarded \$430,000 for "Experimental Elementary Particle Physics," by the National Science Foundation.
- A. Honig, Dept. of Physics, awarded \$290,570 for "Nuclear Spin Polarized HD, D₂, HT, and DT Solids, Liquids and High Density Gases," by the Dept. of Energy.
- P. Souder, Physics Dept., awarded \$355,000 for "Medium Energy Physics," by the Dept. of Energy.
- G. Martin, Chemical Engineering and Materials Science, awarded \$29,961 for "The Characterization and Processing of Polymer Composites for Packaging Applications," by IBM.
- L. Tavlarides, Chemical Engineering and Materials Science, awarded \$105,986 for "Modeling of Electrostatic Corona Discharge Reactor."
- C. Tien, Dept. of Chemical Engineering and Materials Science, awarded \$67,053 for "Particle Deposition in Membrane Processes," by the National Science Foundation.
- C. Driscoll, Civil Engineering, awarded \$60,000 for "Presidential Young Investigator Award Matching Research Funds," by various donors.

- J. Katzer, Information Studies, for "Impact of Anaphoric Resolution in Information Retrieval," by the National Science Foundation.
- R. Letterman, Civil Engineering, awarded \$33,599 for "Control of Residual Aluminum in Filtered Water," by AWWA Research Foundation.
- C. Isik, Electrical and Computing Engineering, awarded \$75,000 for "Robotics Control Lab," by Westinghouse.
- K. Jabbour and W. Meyer, Institute for Energy Research, awarded \$190,899 for "Impact of the Weather on Generation Forecasting and System State," by Niagara Mohawk.
- W. Meyer and B. Bozeman, Institute for Energy research, awarded \$66,448 for "Industrial Process Technology Assessment," by Niagara Mohawk.
- W. Meyer, Institute for Energy research, awarded \$8,000 for "Energy Advisory Service to Industry -- Syracuse Region," by New York State Energy Research Development Association.
- H. Liu, Dept. of Mechanical and Aerospace Engineering, awarded \$312,850 for "Analysis of Fatigue Crack Growth Mechanism and Oxidation and Fatigue Lives," by NASA.
- V. Murthy, Dept. of Mechanical and Aerospace Engineering, awarded \$135,506 for "Linear and Nonlinear Dynamic Analysis of Redundant Load Path Bearingless Rotor Systems," by NASA.
- R. Perkins, Dept. of Mechanical and Aerospace Engineering, awarded \$70,976 for "Mechanics Model for Heterogenous Low Basis Weight Paper Materials," by Proctor and Gamble.
- J. Swingen and S. Long, School of Management, awarded \$132,000 for "The Impact of Complexity on Tax Compliance," by the National Science Foundation.
- S. Thorson, Dept. of Political Science, awarded \$56,662 for "Role of Computers in Crisis Management," by the MacArthur Foundation.
- L. Kriesberg, Sociology Dept., awarded \$200,000 for "Program on Conflict Analysis and Resolution," by the Hewlett Foundation.

LIST OF DATABASES AVAILABLE FROM DIALOG*

AGRICULTURE AND NUTRITION

AGRICOLA (10, 110)
 AGRIBUSINESS U.S.A.SM (581)
 AGRIS (203)
 BIOSIS PREVIEWS^{*} (5)
 CAB ABSTRACTS (50, 53)
 CFS/USDA (60)
 FOOD SCIENCE AND TECHNOLOGY ABSTRACTS (51)
 FOODS ADLIBRATM (79)

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BOOK REVIEW INDEX (137)
 BOOKS IN PRINT (470)
 BRITISH BOOKS IN PRINT (430)
 DIALOG^{*} PUBLICATIONS (200)
 GPO MONTHLY CATALOG (66)
 GPO PUBLICATIONS REFERENCE FILE (166)
 LC MARC (426, 427)
 R MARC (421-425)
 WILEY CATALOG/ONLINE (471)

BUSINESS**PUBLIC COMPANIES**

BUSINESSWIRE (610)
 DIALOG^{*} QUOTES AND TRADING (QUOTES)^{*}
 DISCLOSURE^{*} FINANCIALS (100)
 DISCLOSURE^{*} MANAGEMENT (541)
 DISCLOSURE^{*}/SPECTRUM OWNERSHIP (540)^{*}
 INVESTEXT^{*} (545)
 MEDIA GENERAL DATABANK (546)
 MOODY'S^{*} CORPORATE NEWS - U.S. (556)
 MOODY'S^{*} CORPORATE PROFILES (555)
 PTS ANNUAL REPORTS (17)
 STANDARD & POOR'S CORPORATE DESCRIPTIONS (133)
 STANDARD & POOR'S NEWS (132, 134)

CORPORATE DIRECTORIES

CORPORATE AFFILIATIONS (513)
 D&B - DUN'S ELECTRONIC DIRECTORY OF EDUCATION (511)
 D&B - DUN'S ELECTRONIC YELLOW PAGES
 D&B - DUN'S CONSTRUCTION DIRECTORY (507)
 D&B - DUN'S FINANCIAL SERVICES DIRECTORY (501)
 D&B - DUN'S MANUFACTURERS DIRECTORY (510)
 D&B - DUN'S PROFESSIONALS DIRECTORY (502)
 D&B - DUN'S RETAILERS DIRECTORY (504, 505, 506)
 D&B - DUN'S SERVICES DIRECTORY (508, 509)
 D&B - DUN'S WHOLESALEERS DIRECTORY (503)
 D&B - DUN'S FINANCIAL RECORDSSM (519)^{*}
 D&B - DUN'S MARKET IDENTIFIERS^{*} (516)
 D&B - MILLION DOLLAR DIRECTORY^{*} (517)
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 STANDARD & POOR'S REGISTER - CORPORATE (527)
 THOMAS REGISTER ONLINETM (535)
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 TRINET COMPANY DATABASE (532)

INTERNATIONAL COMPANIES

D&B - CANADIAN DUN'S MARKET IDENTIFIERS^{*} (520)
 D&B - INTERNATIONAL DUN'S MARKET IDENTIFIERS^{*} (518)
 FOREIGN TRADERS INDEX (105)^{*}
 OPPENSTEDT DIRECTORY OF GERMAN COMPANIES (529)
 ICC BRITISH COMPANY DIRECTORY (561)
 ICC BRITISH COMPANY FINANCIAL DATASHEETS (562)
 INVESTEXT^{*} (545)
 MOODY'S^{*} CORPORATE NEWS - INTERNATIONAL (557)

ECONOMIC DATA

BLS CONSUMER PRICE INDEX (175)
 BLS PRODUCER PRICE INDEX (176)
 BLS EMPLOYMENT, HOURS, AND EARNINGS (178)
 CENDATATM (580)^{*}
 CHASE ECONOMETRICS (565)
 D&B - DONNELLEY DEMOGRAPHICS (575)
 PTS U.S. FORECASTS (81)
 PTS U.S. TIME SERIES (82)
 PTS INTERNATIONAL FORECASTS (83)

FINANCIAL NEWS

AMERICAN BANKER (625)
 AMERICAN BANKER NEWS (BANKNEWS)
 THE BOND BUYER (626)
 DIALOG^{*} QUOTES AND TRADING (QUOTES)^{*}
 FINANCIAL TIMES COMPANY ABSTRACTS (560)
 FINANCIAL TIMES FULLTEXT (622)
 STANDARD & POOR'S NEWS (132)
 MOODY'S^{*} CORPORATE NEWS - INTERNATIONAL (557)
 MOODY'S^{*} CORPORATE NEWS - U.S. (556)

MARKETS, PRODUCTS, TECHNOLOGIES

ARTHUR D. LITTLE/ONLINE (192)^{*}
 BUSINESS & INDUSTRY NEWS (602)
 FINDEX REPORTS AND STUDIES (196)
 INDUSTRY DATA SOURCESTM (189)
 INVESTEXT^{*} (545)
 MCGRAW-HILL BUSINESS BACKGROUNDER (624)
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 TRADE & INDUSTRY INDEXTM (148)
 TRADE & INDUSTRY ASAPTM (648)

INDUSTRIES

AGRIBUSINESS U.S.A.SM (581)
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 FINIS: FINANCIAL INDUSTRY INFORMATION SERVICE (268)
 INSURANCE ABSTRACTS (168)
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 P/E NEWS (257)
 PHARMACEUTICAL NEWS INDEX (42)
 PTS AEROSPACE/DEFENSE MARKETS & TECHNOLOGY (80)
 PTS MARKETING & ADVERTISING REFERENCE SERVICE (570)
 TRADE OPPORTUNITIES (106)^{*}
 TRADE OPPORTUNITIES WEEKLY (107)^{*}

PRODUCT LISTINGS & ANNOUNCEMENTS

BUSINESS SOFTWARE DATABASETM (256)
 CONSUMER REPORTS (646)
 PTS NEW PRODUCT ANNOUNCEMENTS (621)
 THOMAS NEW INDUSTRIAL PRODUCTSTM (536)
 THOMAS REGIONAL INDUSTRIAL SUPPLIERSTM (537)
 THOMAS REGISTER ONLINETM (535)

GENERAL BUSINESS INFORMATION

ABI/INFORM^{*} (15)
 ECONOMIC LITERATURE INDEX (139)
 FOREIGN TRADE & ECON ABSTRACTS (90)^{*}
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 MANAGEMENT CONTENTS^{*} (75)

BUSINESS NEWS

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 UPI NEWS (260, 261)
 WASHINGTON POST ELECTRONIC EDITION (146, 147)

INTERNATIONAL BUSINESS INFORMATION

CANADIAN BUSINESS AND CURRENT AFFAIRS (262)
 INVESTEXT* (545)
 MOODY'S* CORPORATE NEWS - INTERNATIONAL (557)
 PTS PROMT (16)
 PTS F&S INDEXES (18)

TRAVEL

OAG ELECTRONIC EDITION (OAG)*

CHEMISTRY

THE AGROCHEMICALS HANDBOOK (306)
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 CA SEARCH (399, 308, 309, 310, 311, 312)
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 PAPERCHEM (240, 840)
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COMPUTER SCIENCE

BUSINESS SOFTWARE DATABASE™ (256)
 COMPENDEX* (8)
 COMPUTER DATABASE™ (275)
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 .MENU™-THE INTERNATIONAL SOFTWARE DATABASE™ (232)
 MICROCOMPUTER INDEX™ (233)
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CURRENT AFFAIRS

AP NEWS (258, 259)
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 CHRONOLOG* NEWSLETTER (410)
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 STANDARD & POOR'S NEWS (132, 134)
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DEFENSE

NTIS (6)
 PTS AEROSPACE/DEFENSE MARKETS & TECHNOLOGY (80)
 AEROSPACE DATABASE (108)*
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 FEDERAL RESEARCH IN PROGRESS (265)
 DMS CONTRACT AWARDS (588)
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DIRECTORIES

AMERICAN MEN AND WOMEN OF SCIENCE (236)
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 CLAIMS™ COMPREHENSIVE DATABASE (323-325)¹
 CLAIMS™/REASSIGNMENT & REEXAMINATION (123)¹
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